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Explanation of the Causal Model of Digital Leadership Based on Information Culture on Information Literacy of History Teachers in Salah al-Din Province, Iraq

ABSTRACT

The present study was conducted with the aim of presenting an “Explanation of the Causal Model of Digital Leadership Based on Information Culture on the Information Literacy of History Teachers in Salah al-Din Province, Iraq.” The statistical population of the study included all history teachers in Salah al-Din Province, Iraq, totaling 200 individuals. Based on Cochran’s sample size formula, 127 teachers were selected as the statistical sample. Participants responded to a researcher-made questionnaire on digital leadership based on information culture and the information literacy questionnaire developed by Davarpanah (2009). The results of the thematic analysis indicated 14 organizing themes, each of which more precisely covered different dimensions of digital leadership. These organizing themes included: a knowledge-based cultural context, transparent and accountable leadership, continuous organizational learning, trust-based cohesion, integration of information systems, advanced knowledge-oriented technologies, dynamic and flexible structures, system-based transparency, valuing organizational knowledge, convergence of culture and knowledge, innovation as culture, collective organizational participation, organizational accountability, and culture-centered transformation. In total, 56 basic themes were extracted from the interviews, each uniquely and non-redundantly adding detail and depth to the organizing and overarching themes. These basic themes comprehensively covered various aspects of digital leadership based on information culture and contributed to a more holistic understanding of the research topic. In the quantitative phase, using statistical methods and structural equation modeling (SEM), the effect of digital leadership based on information culture on the information literacy of history teachers was examined. The quantitative results demonstrated that digital leadership grounded in information culture has a direct and significant effect on the information literacy of history teachers.

Keywords: Digital leadership, Information culture, Information literacy, Teachers.

Introduction

In the rapidly evolving context of the digital age, leadership has become a multidimensional phenomenon characterized by complexity, interconnectivity, and the continuous emergence of new technologies. The traditional paradigms of leadership—based on hierarchical control and authority—have increasingly given way to adaptive, participative, and technology-oriented leadership models that enable organizations to navigate digital transformation successfully (1). As organizations integrate digital technologies into all aspects of management and education, digital leadership has emerged as a crucial determinant of organizational performance, employee engagement, and innovation capacity (2). The role of leaders, therefore, extends beyond managing human resources to orchestrating digital infrastructures, data-driven processes, and virtual collaborations that sustain competitive advantage in dynamic environments (3).

In educational and public institutions, digital leadership has gained prominence as a catalyst for fostering innovation and enhancing organizational adaptability (2). It is defined by the ability of leaders to strategically utilize digital tools, encourage a digital culture, and enable a transformation that aligns with institutional goals (1). This paradigm emphasizes collaboration, information sharing, and creativity—values that are essential for success in a knowledge-based society (4). Research has shown that digital leaders influence both the technological and cultural dimensions of an organization, integrating information systems to enhance learning and operational efficiency (5). Within the education sector, the shift towards digital environments has been accelerated by global challenges, including the COVID-19 pandemic, which underscored the necessity for resilient and technology-savvy leadership (6).

As a result, educational institutions are increasingly seeking leaders who possess digital competencies capable of supporting teachers, students, and administrative systems in adopting technology-enhanced practices (7). These leaders are expected to bridge the gap between human potential and technological innovation by cultivating digital literacy, fostering collaborative knowledge networks, and encouraging creative problem-solving (3). The development of digital leadership competencies within education reflects not only a managerial necessity but also a pedagogical transformation, as it directly influences the quality of instruction, student engagement, and learning outcomes (8).

At the organizational level, leadership theory has evolved to include models that emphasize transformational, authentic, and servant leadership styles, each contributing uniquely to digital transformation and innovation (9-11). Transformational leadership, for instance, is particularly suited to the digital era because it inspires followers to embrace change, challenges them to think creatively, and fosters a shared vision for technological progress (12). Studies indicate that transformational leaders facilitate digital adoption by motivating employees to experiment with new tools and by promoting a culture of continuous learning (9, 13). Similarly, servant leadership—rooted in empathy, trust, and empowerment—has been shown to enhance performance by fostering communication and collaboration through digital channels (11). In contrast, authentic leadership focuses on transparency and moral integrity, helping to build trust in technology-driven organizational change (14, 15). These leadership models, though conceptually distinct, share a common focus on adaptability, ethical stewardship, and the effective use of technology in achieving strategic objectives.

Digital leadership also integrates aspects of sustainability and responsible governance. In today's interconnected global systems, leaders must balance technological advancement with ethical responsibility, environmental awareness, and social inclusion (16). Sustainable leadership emphasizes long-term value creation through digital innovation while ensuring that organizations remain committed to human development, equality, and transparency (16). Such an approach is particularly relevant in educational and public institutions, where the impact of leadership extends beyond organizational performance to shaping cultural norms and societal progress (2).

Moreover, digital leadership's relationship with organizational learning and knowledge sharing has become a core research focus. Organizations that adopt a knowledge-oriented leadership approach are better positioned to cultivate innovation, enhance employee competencies, and improve organizational resilience (17). Knowledge-based leadership builds on the premise that effective digital transformation depends not only on technological infrastructure but also on the human capacity to generate, share, and apply knowledge (17, 18). This integration of leadership, knowledge management, and digital technology forms the backbone of modern strategic management frameworks. By fostering an environment where information is freely exchanged, digital leaders empower employees to engage in collaborative problem-solving and continuous improvement (18).

Empirical studies have further highlighted the mediating role of digital leadership in linking technology adoption to organizational outcomes. Leaders who model technological competence encourage employees to use digital platforms more effectively, thereby enhancing performance and innovation (1, 9). Digital leadership practices, such as promoting e-learning, facilitating virtual teamwork, and adopting data-driven decision-making, are essential for sustaining organizational agility and competitive advantage (1, 4). In the education sector, these practices contribute directly to improving teachers' digital competencies and the overall effectiveness of the learning environment (6, 7).

In public sector organizations, the shift toward digital governance and smart management has led to renewed attention on digital leadership competencies tailored to administrative contexts (2). Public sector digital leaders must navigate bureaucratic constraints while driving cultural and technological innovation. They are expected to integrate data analytics, automate processes, and improve service delivery without compromising transparency and accountability. Such competencies require not only technological literacy but also interpersonal skills that foster collaboration across departments (2, 16).

From a socio-technological perspective, the literature also emphasizes that digital transformation is not merely a technical process but a human-centered evolution (4). Leaders must, therefore, manage the psychological and emotional dimensions of digital change, including resistance to technology, anxiety toward digital tools, and the need for self-efficacy in virtual environments (4). Research indicates that leaders who create a supportive digital culture—characterized by inclusivity, transparency, and psychological safety—enhance employee willingness to experiment with technology and engage in innovative behavior (10, 12). Thus, digital leadership represents both a technological and an emotional competency that bridges digital adoption with human development.

In educational settings, the importance of leadership that integrates information culture is particularly evident. Schools and universities are increasingly viewed as ecosystems of knowledge creation, where leaders play a central role in fostering digital literacy and innovation (5). Studies suggest that digital leaders in education influence teachers' attitudes toward technology, thereby affecting the quality of digital instruction and student outcomes (6, 7). Moreover, by cultivating a shared information culture, digital leaders promote transparency, collective learning, and collaborative problem-solving (13, 14). In such environments, information literacy becomes a vital skill that enables both teachers and students to critically assess and use digital resources effectively (3).

The digitalization of education also calls for redefining teacher competencies to align with future learning ecosystems. According to Miboodi et al. (2023), digital competence for instructors encompasses not only technical skills but also pedagogical and ethical dimensions that empower educators to guide students in a digital society (7). Similarly, Ghofrani and Khanifar (2020) highlight that assessing the digital competence of student-teachers is essential for ensuring that educational systems remain adaptive and future-oriented (6). Leadership in such contexts must therefore be visionary, fostering the integration of technology into pedagogical strategies while maintaining the humanistic values of education (8).

Furthermore, leadership in the digital era requires the ability to manage diverse technological infrastructures and align them with organizational strategy. As Yao et al. (2023) note, the penetration effect of digital leadership is evident through its capacity

to create consensus on digital strategy and integrate diverse digital tools for organizational synergy (1). Leaders with a high level of digital maturity can effectively manage digital ecosystems and ensure alignment between technology, strategy, and human capital (5). In turn, this alignment contributes to greater organizational agility and resilience, both critical for sustaining competitive advantage in volatile environments (12).

Recent empirical findings also reveal that digital leadership enhances employees' innovative work behaviors through mechanisms such as leader-member exchange, voice behavior, and knowledge sharing (10). By emphasizing empowerment and open communication, digital leaders cultivate environments where employees feel valued and motivated to contribute to innovation (10, 17). Similarly, studies show that leadership styles that prioritize motivation and transformational vision positively affect employee performance when coupled with information technology adoption (9). Therefore, the interplay between leadership behavior, technological competence, and information culture forms the foundation for digital transformation in both private and public institutions (11, 16).

Within this emerging discourse, sustainable digital leadership represents a synthesis of transformational, authentic, and knowledge-based models, oriented toward ethical, inclusive, and future-focused governance (16). It ensures that digital transformation supports not only efficiency and performance but also sustainability and social well-being (16). For education and public administration, such leadership is essential to achieve long-term strategic goals, including equitable access to digital resources, teacher empowerment, and knowledge democratization (2).

As digital transformation continues to reshape the landscape of education and management, leadership remains the decisive factor in determining whether institutions can leverage technology effectively and sustainably (8, 13). The convergence of leadership theory, information culture, and digital competence underscores a new era in organizational development—one where leaders must integrate human values with technological foresight to foster innovation, adaptability, and collective intelligence (1, 4).

Therefore, the aim of this study is to explain the causal model of digital leadership based on information culture and its impact on the information literacy of history teachers in Salah al-Din Province, Iraq.

Methods and Materials

Considering the objectives addressed in the present study, a mixed-methods approach was adopted. Accordingly, among the various types of mixed-method designs, the present study utilized a guided sequential exploratory mixed-method approach with a classification orientation. In the sequential exploratory method, priority is given to the qualitative phase, and the subsequent quantitative phase benefits from the results of the qualitative findings.

The first phase of this study, in terms of purpose, was applied, and in terms of nature and method, was descriptive–survey. Initially, by reviewing the theoretical foundations related to digital leadership, the factors contributing to the successful implementation of this leadership style in organizations were identified through thematic analysis. Subsequently, the relationships among these factors were evaluated by experts and specialists in the field using the Delphi method. Through this process, the identified dimensions and components were screened, and the final list of dimensions was determined. Then, using the Interpretive Structural Modeling (ISM) method, the variables were hierarchically structured and prioritized. Based on Cochran's sample size formula, 127 history teachers from Salah al-Din Province, Iraq, were selected as the statistical sample.

Findings and Results

In the thematic analysis, key point coding was applied. A total of 14 interviews with experts in the field were conducted, all of which were deemed suitable for transcription and analysis. The interview transcripts (all key points) were examined to

extract initial codes, and the results of this coding are presented in Table (1). To maintain the confidentiality of the interview participants, each interviewee was represented with the code M/X, where M indicates the interview, / denotes the interview number, and X represents the number of the initial code extracted from the interview text.

Table 1. Analysis of Key Points from the Conducted Interviews

Interview Text	Conceptual Codes	Interviewee Code
In my opinion, digital leadership in the present era requires a deep understanding of information culture. Information culture, as a platform for knowledge sharing, plays a key role in organizational success. I believe that digital leaders should create an open and transparent environment that facilitates knowledge exchange among employees. This requires leaders to focus on empowering employees rather than merely controlling them.	Information culture as a platform for knowledge sharing; Creating an open and transparent environment for knowledge exchange; Empowering employees instead of mere control; The role of digital leadership in organizational success	M1/1
From my perspective, digital leadership cannot be fully realized without considering knowledge-sharing behavior. I believe knowledge sharing should be institutionalized as an organizational value. This requires changing attitudes and building trust among employees. Digital leaders should use modern technologies to facilitate knowledge-sharing processes.	Knowledge sharing as an organizational value; Changing attitudes to build trust; Using modern technologies to facilitate knowledge sharing; Institutionalizing knowledge-sharing behavior	M2/2
In my view, digital leadership must be based on transparency and accountability. Such transparency should be evident not only in decision-making but also in knowledge sharing. I believe digital leaders should establish integrated information systems to provide equal access to knowledge for all employees.	Transparency and accountability in digital leadership; Establishing integrated information systems; Equal access to knowledge for all employees; Transparency in decision-making and knowledge sharing	M3/3
I believe digital leadership requires an approach that simultaneously strengthens information culture and knowledge-sharing behavior. Leaders should motivate employees to actively participate in knowledge-sharing processes. This requires creating an environment in which knowledge sharing is accepted as a social norm.	Simultaneous strengthening of information culture and knowledge sharing; Motivating active participation in knowledge sharing; Knowledge sharing as an organizational norm; Creating a supportive environment for knowledge sharing	M4/4
In my opinion, digital leadership should be grounded in continuous learning. Digital leaders must foster a learning culture that encourages employees to continually update their knowledge. This necessitates systems that provide employees with access to up-to-date knowledge resources.	Continuous learning as the foundation of digital leadership; Creating a learning culture in the organization; Encouraging employees to update knowledge; Access to up-to-date knowledge resources	M5/5
I believe digital leadership should balance technology and human orientation to enhance knowledge-sharing behavior. Leaders should use digital technologies to facilitate knowledge sharing while preserving the human element in the process.	Balance between technology and human orientation; Facilitating knowledge sharing through technology; Preserving the human role in knowledge sharing; Enhancing knowledge-sharing behavior through balance	M6/6
In my opinion, digital leadership should be based on trust and collaboration. Digital leaders should build trust among employees to create conditions for cooperation and knowledge sharing. This requires an environment where employees feel safe and valued.	Trust and collaboration as the foundation of digital leadership; Building trust among employees; Enabling cooperation and knowledge sharing; Creating a sense of safety and value among employees	M7/7
I believe digital leadership should foster a culture of innovation to enhance knowledge-sharing behavior. Leaders should encourage employees to share new ideas and create an environment that values risk-taking and creativity.	Innovation culture as the foundation of digital leadership; Encouraging employees to generate new ideas; Creating an environment for risk-taking and creativity; Enhancing knowledge sharing through innovation	M8/8
In my opinion, digital leadership should be built upon flexibility and adaptability. Leaders should develop flexible structures that allow employees to adjust to changes. This requires an information culture that provides quick access to necessary information.	Flexibility and adaptability in digital leadership; Creating flexible structures; Enabling employee adaptation to changes; Quick access to necessary information	M9/9
I believe digital leadership should be founded on transparency and fairness. Leaders should implement transparent systems to facilitate knowledge sharing. This requires an environment where all employees feel equality and justice.	Transparency and fairness as the foundation of digital leadership; Establishing transparent systems for knowledge sharing; Creating an environment of equality and justice; Knowledge sharing in a fair environment	M10/10
In my view, digital leadership must be based on responsibility and accountability. Leaders should cultivate a culture of responsibility to encourage employees' active participation in knowledge sharing. This requires systems that instill a sense of responsibility in employees.	Responsibility and accountability in digital leadership; Creating a culture of responsibility; Encouraging active participation in knowledge sharing; Instilling a sense of responsibility in employees	M11/11
I believe digital leadership should rely on coordination and alignment. Leaders should harmonize various departments within the organization to promote knowledge sharing. This requires systems that allow free information flow between units.	Coordination and alignment in digital leadership; Harmonizing organizational departments; Free flow of information across departments; Knowledge sharing in a coordinated environment	M12/12

In my opinion, digital leadership should emphasize participation and interaction. Leaders should develop a participatory culture to encourage employee engagement in knowledge sharing. This requires an environment where employees feel belonging and involvement.	Participation and interaction as the foundation of digital leadership; Creating a participatory culture; Encouraging employee interaction and knowledge sharing; Fostering a sense of belonging and engagement	M13/13
I believe digital leadership should rest upon transformation and change. Leaders should build a transformational culture that encourages employees to embrace change and share knowledge. This necessitates an environment where change is viewed as an opportunity for growth.	Transformation and change as the foundation of digital leadership; Building a transformational culture; Encouraging employees to accept change; Viewing change as an opportunity for growth	M14/14

Subsequently, once all data were coded, themes were developed, and after revising and defining them, the results were categorized into basic, organizing, and overarching themes as presented in Table (2).

Table 2. Overarching, Organizing, and Basic Themes

Overarching Themes	Organizing Themes	Basic Themes
Perception of Digital Leadership Based on Information Culture	Knowledge-Based Cultural Context	Information culture as a platform for knowledge sharing – Creating an open and transparent environment for knowledge exchange – Empowering employees instead of mere control – The role of digital leadership in organizational success
	Transparent and Accountable Leadership	Transparency and accountability in digital leadership – Establishing integrated information systems – Equal access to knowledge for all employees – Transparency in decision-making and knowledge sharing
	Continuous Organizational Learning	Continuous learning as the foundation of digital leadership – Creating a learning culture within the organization – Encouraging employees to update their knowledge – Access to up-to-date knowledge resources
	Trust-Based Cohesion	Trust and collaboration as the foundation of digital leadership – Building trust among employees – Creating opportunities for cooperation and knowledge sharing – Creating a sense of safety and value among employees
Mechanisms of Information Culture in Digital Leadership	Integration of Information Systems	Establishing integrated information systems – Quick access to required information – Free flow of information between departments – Transparency in decision-making and knowledge sharing
	Knowledge-Oriented Advanced Technologies	Using modern technologies to facilitate knowledge sharing – Balancing technology and human orientation – Facilitating knowledge-sharing processes through technology – Preserving the human role in knowledge sharing
	Dynamic and Flexible Structures	Creating flexible organizational structures – Enabling employees to adapt to changes – Quick access to necessary information – Creating an environment that encourages risk-taking and creativity
	System-Based Transparency	Establishing transparent systems for knowledge sharing – Creating an environment of equality and fairness – Knowledge sharing in a fair environment – Transparency and fairness as the foundation of digital leadership
Perception of Digital Leadership Based on Knowledge Sharing	Valuing Organizational Knowledge	Knowledge sharing as an organizational value – Changing attitudes to build trust – Institutionalizing knowledge-sharing behavior – Creating a supportive environment for knowledge sharing
	Convergence of Culture and Knowledge	Simultaneous strengthening of information culture and knowledge sharing – Motivating active participation in knowledge sharing – Knowledge sharing as an organizational norm – Improving knowledge-sharing behavior through the balance of technology and humanity
	Innovation as Culture	Innovation culture as the foundation of digital leadership – Encouraging employees to present new ideas – Creating an environment that promotes risk-taking and creativity – Enhancing knowledge-sharing behavior through innovation
Mechanisms of Knowledge Sharing in Digital Leadership	Collective Organizational Participation	Creating a participatory culture within the organization – Encouraging employees to engage in interaction and knowledge sharing – Fostering a sense of belonging and participation among employees – Participation and interaction as the foundation of digital leadership
	Organizational Accountability	Creating a culture of accountability – Encouraging employees to actively participate in knowledge sharing – Instilling a sense of responsibility in employees – Responsibility and accountability in digital leadership
	Culture-Oriented Transformation	Building a culture of transformation within the organization – Encouraging employees to accept changes – Viewing changes as opportunities for growth – Transformation and change as the foundation of digital leadership

Extensive and in-depth interviews were conducted with prominent experts and specialists in the field of digital leadership to examine various dimensions of information culture from the perspectives of senior managers, information technology professionals, and knowledge management scholars. The interviewees, with their rich backgrounds and diverse experiences in

strategic management, emerging technologies, and organizational leadership, provided valuable and profound insights that greatly contributed to understanding the competencies required of digital leaders in the modern era. These interviews not only identified the challenges and opportunities facing digital leadership but also explored practical strategies for improving information culture and knowledge sharing in organizations.

One of the interviewees stated:

“Digital leadership without a deep understanding of information culture and knowledge sharing is like a ship without a compass. Leaders must create an open and transparent environment that facilitates the exchange of knowledge among employees. This not only enhances organizational productivity but also strengthens innovation and creativity. Indeed, information culture, as a foundation for knowledge sharing, plays a key role in organizational success. Digital leaders must build trust and transparency to encourage employees’ active participation in the process of knowledge sharing. This requires leaders to focus on empowering employees rather than merely controlling them.”

This perspective highlights that information culture and knowledge sharing are fundamental pillars of digital leadership—a concept widely emphasized in the literature.

Another interviewee remarked:

“In today’s world, digital leadership is not merely about using advanced technologies but about creating a balance between technology and human orientation. Leaders must use modern technologies to facilitate knowledge sharing without diminishing the human role in this process. Digital technologies can serve as powerful tools for knowledge exchange, but it should never be forgotten that humans remain at the core of this process. Digital leaders must achieve a balance between technology and human-centeredness to improve knowledge-sharing behavior. This requires leaders to consider employees’ needs and expectations, rather than relying solely on technology.”

This statement illustrates that maintaining a balance between technology and human-centeredness is one of the main challenges in digital leadership that requires special attention.

Another expert noted:

“Transparency and accountability are fundamental components of digital leadership. Leaders should establish integrated information systems that provide access to knowledge for all employees. Transparency should be evident not only in decision-making but also in knowledge sharing. In digital leadership, transparency means that all employees can access the information they need and participate in decision-making processes. This enhances employees’ trust in their leaders and fosters knowledge sharing. Digital leaders should create transparent systems that ensure fairness and equality among employees.”

This view emphasizes that transparency and accountability function as key factors in the success of digital leadership.

Another interviewee explained:

“Continuous learning, as the foundation of digital leadership, plays a vital role in organizational success. Leaders must create a learning culture that encourages employees to constantly update their knowledge. This requires systems that provide employees with access to the most current knowledge resources. Continuous learning means that employees consistently renew their skills and stay informed about the latest developments in their field. Digital leaders should foster a learning culture that motivates active participation in knowledge-sharing processes. To achieve this, leaders must focus on employee empowerment rather than control.”

This highlights that continuous learning is one of the fundamental pillars of digital leadership and demands focused attention.

Another expert stated:

“Trust and collaboration form the foundation of digital leadership and play a crucial role in knowledge sharing. Leaders must build trust among employees to promote cooperation and knowledge exchange. This requires an environment in which

employees feel safe and valued. In organizations, trust means that employees can share their knowledge freely without fear of judgment or punishment. Building trust not only enhances productivity but also strengthens innovation and creativity.”

This viewpoint demonstrates that trust and collaboration serve as essential components in the success of digital leadership.

Finally, another interviewee expressed:

“An innovation culture, as the foundation of digital leadership, significantly contributes to improving knowledge-sharing behavior. Leaders should encourage employees to generate new ideas and create an environment that promotes risk-taking and creativity. An innovation culture allows employees to share their ideas without fear of failure and to participate actively in the innovation process. Digital leaders should focus on empowerment rather than control to encourage participation in knowledge sharing.”

This statement underscores that an innovation culture is one of the core pillars of digital leadership and deserves particular attention.

Another participant added:

“Establishing a culture of participation within the organization plays a key role in knowledge sharing. Leaders must encourage employees to engage in interaction and exchange knowledge in an environment that fosters belonging and participation. Participation means that employees are involved in decision-making and problem-solving processes. By creating a participatory culture, digital leaders can motivate employees to actively engage in knowledge-sharing activities. This requires leaders to empower rather than merely supervise employees.”

This perspective illustrates that participation and interaction are essential elements for the success of digital leadership.

To examine reliability, the method of having at least two individuals conduct the interviews separately but in parallel and then comparing the findings of the two (or several) researchers was employed. Accordingly, all stages of interviewing and coding were performed in parallel by two individuals, and identical results were obtained. A subset of the interview data was recoded by a second researcher: approximately 20% of the interviews (four interviews) were provided to a second researcher familiar with qualitative methodology and knowledgeable about the study topic, and the percentage agreement in coding was calculated. This index reflects intra-topic agreement between two different coders. The results, presented in Table (3), are acceptable.

Table 3. Calculation of Inter-Coder Reliability at the Interview Stage

Interview No.	Total Codes	Agreements	Disagreements	Inter-Coder Reliability (%)
2	37	17	3	91.89
4	31	13	5	83.87
13	34	16	2	94.12
15	38	18	2	94.74
Total	140	64	12	91.43

The Delphi method was used to achieve expert consensus on the overarching and organizing themes related to digital leadership based on information culture. This process was conducted in two rounds. In each round, experts evaluated and rated the themes, and the mean scores and the coefficient of agreement were calculated. The tables for each round, together with interpretation and explanations, are presented below.

Table 4. Delphi Round One

Overarching Themes	Organizing Themes	Mean	Coefficient of Agreement	Result
Perception of digital leadership based on information culture	Knowledge-based cultural context	5.20	0.66	Approved
	Transparent and accountable leadership	5.93	0.81	Approved

Mechanisms of information culture in digital leadership	Continuous organizational learning	5.22	0.62	Approved
	Trust-based cohesion	5.24	0.71	Approved
	Integration of information systems	5.28	0.67	Approved
Perception of digital leadership based on knowledge sharing	Knowledge-oriented advanced technologies	6.00	0.80	Approved
	Dynamic and flexible structures	5.50	0.70	Approved
	System-based transparency	5.30	0.79	Approved
	Valuing organizational knowledge	5.29	0.75	Approved
Mechanisms of knowledge sharing in digital leadership	Convergence of culture and knowledge	5.97	0.67	Approved
	Innovation as culture	6.04	0.81	Approved
	Collective organizational participation	5.42	0.72	Approved
	Organizational accountability	–	–	Requires revision
	Culture-oriented transformation	5.38	0.67	Approved

In Delphi Round One, most organizing themes were approved with mean scores above 5 and a coefficient of agreement above 0.60. However, the theme “Organizational accountability” required revision due to an insufficient coefficient of agreement. The remaining themes, given their high agreement and suitable mean scores, were forwarded to the second round.

Table 5. Delphi Round Two

Overarching Themes	Organizing Themes	Mean	Coefficient of Agreement	Result
Perception of digital leadership based on information culture	Knowledge-based cultural context	5.22	0.75	Approved
	Transparent and accountable leadership	5.95	0.85	Approved
	Continuous organizational learning	5.24	0.70	Approved
Mechanisms of information culture in digital leadership	Trust-based cohesion	5.26	0.78	Approved
	Integration of information systems	5.30	0.72	Approved
	Knowledge-oriented advanced technologies	6.02	0.82	Approved
	Dynamic and flexible structures	5.52	0.75	Approved
Perception of digital leadership based on knowledge sharing	System-based transparency	5.32	0.80	Approved
	Valuing organizational knowledge	5.31	0.78	Approved
	Convergence of culture and knowledge	5.99	0.72	Approved
Mechanisms of knowledge sharing in digital leadership	Innovation as culture	6.06	0.85	Approved
	Collective organizational participation	5.44	0.75	Approved
	Organizational accountability	5.40	0.70	Approved
	Culture-oriented transformation	5.40	0.72	Approved

In Delphi Round Two, after revision and refinement, the theme “Organizational accountability” was approved with a mean score of 5.40 and a coefficient of agreement of 0.70. The other themes were also finally approved with improvements in mean scores and coefficients of agreement. This improvement indicates the achievement of expert consensus regarding the importance and role of these themes in digital leadership based on information culture.

To test the model of this study, data analysis was conducted using structural equation modeling (SEM) with PLS software. An approximate sample size of 384 individuals was obtained for the second phase of the research; however, to enhance the study’s validity, 400 questionnaires were distributed via simple random sampling among participants, and ultimately 392 were usable for analysis. The results of the tests are examined and presented as follows:

Table 6. Normality Test of Variables

Constructs	Z Statistic	p-Value	Status
Perception of digital leadership based on information culture	3.782	0.003	Non-normal
Mechanisms of information culture in digital leadership	4.069	0.000	Non-normal
Perception of digital leadership based on knowledge sharing	4.592	0.000	Non-normal
Mechanisms of knowledge sharing in digital leadership	4.791	0.000	Non-normal
Information literacy	3.556	0.016	Non-normal

Table 7. KMO and Bartlett's Tests for Sampling Adequacy

Test	Statistic / Value	Approx. Chi-Square	df	Sig.
Kaiser–Meyer–Olkin Measure of Sampling Adequacy	0.879	—	—	—
Bartlett's Test of Sphericity	—	4425.282	13	0.000

Table 8. Convergent Validity and Reliability

Dimensions	Cronbach's Alpha	Rho	Composite Reliability	AVE
Perception of digital leadership based on knowledge sharing	0.980	0.980	0.987	0.961
Perception of digital leadership based on information culture	0.759	0.814	0.852	0.603
Digital leadership based on knowledge-sharing behavior	0.989	0.989	0.991	0.947
Digital leadership based on information culture	0.914	0.935	0.933	0.643
Mechanisms of knowledge sharing in digital leadership	0.976	0.976	0.984	0.955
Mechanisms of information culture in digital leadership	0.952	0.953	0.966	0.875
Information literacy	0.968	0.980	0.972	0.709

Table 9. Average Variance Extracted Across Constructs (Discriminant Validity Check)

	1	2	3	4	5	6	7
1. Perception of digital leadership based on knowledge sharing	0.980						
2. Perception of digital leadership based on information culture	0.543	0.776					
3. Digital leadership based on knowledge-sharing behavior	0.594	0.749	0.973				
4. Digital leadership based on information culture	0.624	0.497	0.627	0.802			
5. Mechanisms of knowledge sharing in digital leadership	0.477	0.447	0.694	0.619	0.977		
6. Mechanisms of information culture in digital leadership	0.440	0.438	0.541	0.560	0.630	0.936	
7. Information literacy	0.564	0.598	0.569	0.556	0.662	0.555	0.842

Table 10. R² Values of the Research Model

Dimensions	Coefficient of Determination (R ²)
Perception of digital leadership based on knowledge sharing	0.989
Perception of digital leadership based on information culture	0.805
Mechanisms of knowledge sharing in digital leadership	0.989
Mechanisms of information culture in digital leadership	0.922
Information literacy	0.663

As shown in Table (10), the R² values for the latent variables indicate the extent to which the dependent variables are explained by the independent variable(s).

Table 11. CV.Redundancy Index Values

Dimensions	SSO	SSE	Q ² (= 1 – SSE/SSO)
Perception of digital leadership based on knowledge sharing	1,173.000	120.741	0.897
Perception of digital leadership based on information culture	1,564.000	860.206	0.450
Digital leadership based on knowledge-sharing behavior	2,346.000	2,346.000	...
Digital leadership based on information culture	3,128.000	3,128.000	...
Mechanisms of knowledge sharing in digital leadership	1,173.000	128.073	0.891
Mechanisms of information culture in digital leadership	1,564.000	378.470	0.758
Information literacy	5,865.000	2,153.139	0.633

Table 12. CV.Community Index Values

Dimensions	SSO	SSE	$Q^2 (= 1 - SSE/SSO)$
Perception of digital leadership based on knowledge sharing	1,173.000	261.884	0.777
Perception of digital leadership based on information culture	3,528.000	1,214.384	0.656
Digital leadership based on knowledge-sharing behavior	2,346.000	339.703	0.855
Digital leadership based on information culture	3,128.000	1,470.714	0.530
Mechanisms of knowledge sharing in digital leadership	1,173.000	272.494	0.768
Mechanisms of information culture in digital leadership	1,564.000	446.793	0.714
Information literacy	5,865.000	2,171.604	0.630

The examination of Q^2 values in Tables (11) and (12) shows that none of the Q^2 values are negative, and the minimum thresholds for predictive relevance have been met.

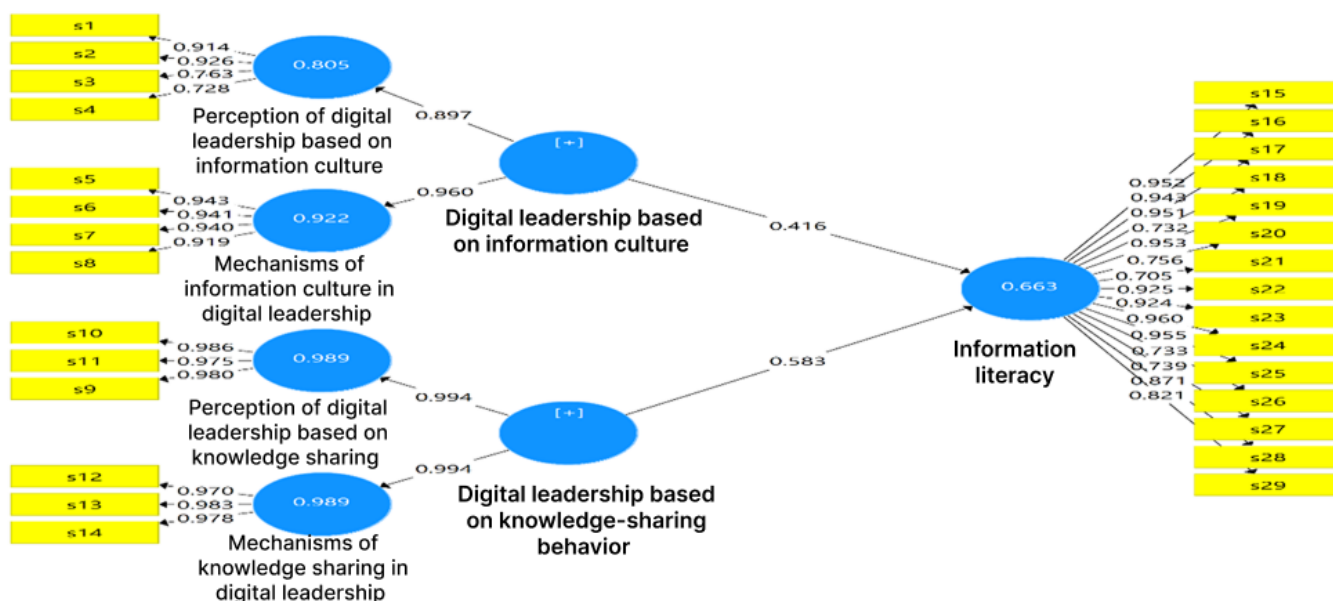


Figure 1. Path Coefficients of the Research Model

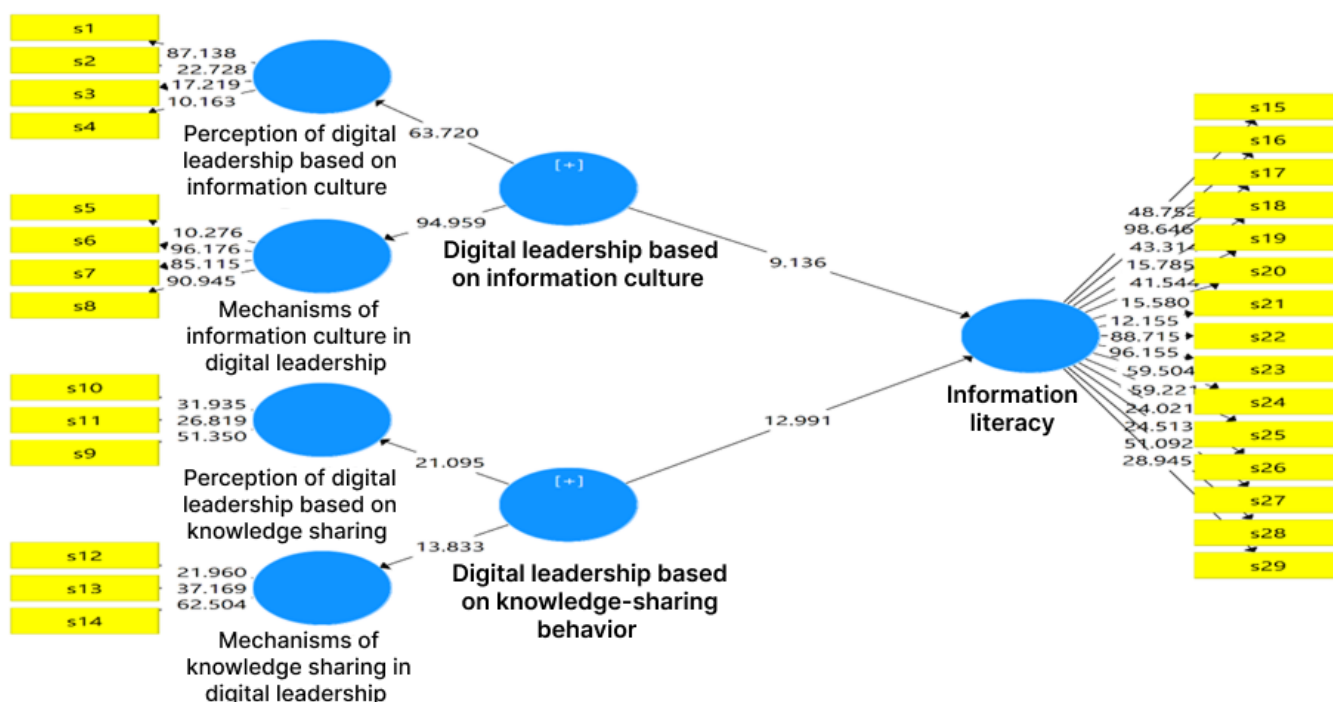


Figure 2. t-Statistics of the Research Model

Figure (1) presents the path coefficients for the research hypotheses. A path coefficient indicates the existence of a linear causal relationship and the magnitude and direction of this relationship between two variables. In essence, it is the standardized regression coefficient, analogous to those observed in simpler simple and multiple regression models. It ranges from -1 to $+1$; a value of zero indicates no linear causal relationship between the two variables.

Figure (2) presents the model's t-statistics. If the t-statistic for a path exceeds 1.96, it can be concluded that the path is significant and the corresponding hypothesis is supported at the 0.05 error level.

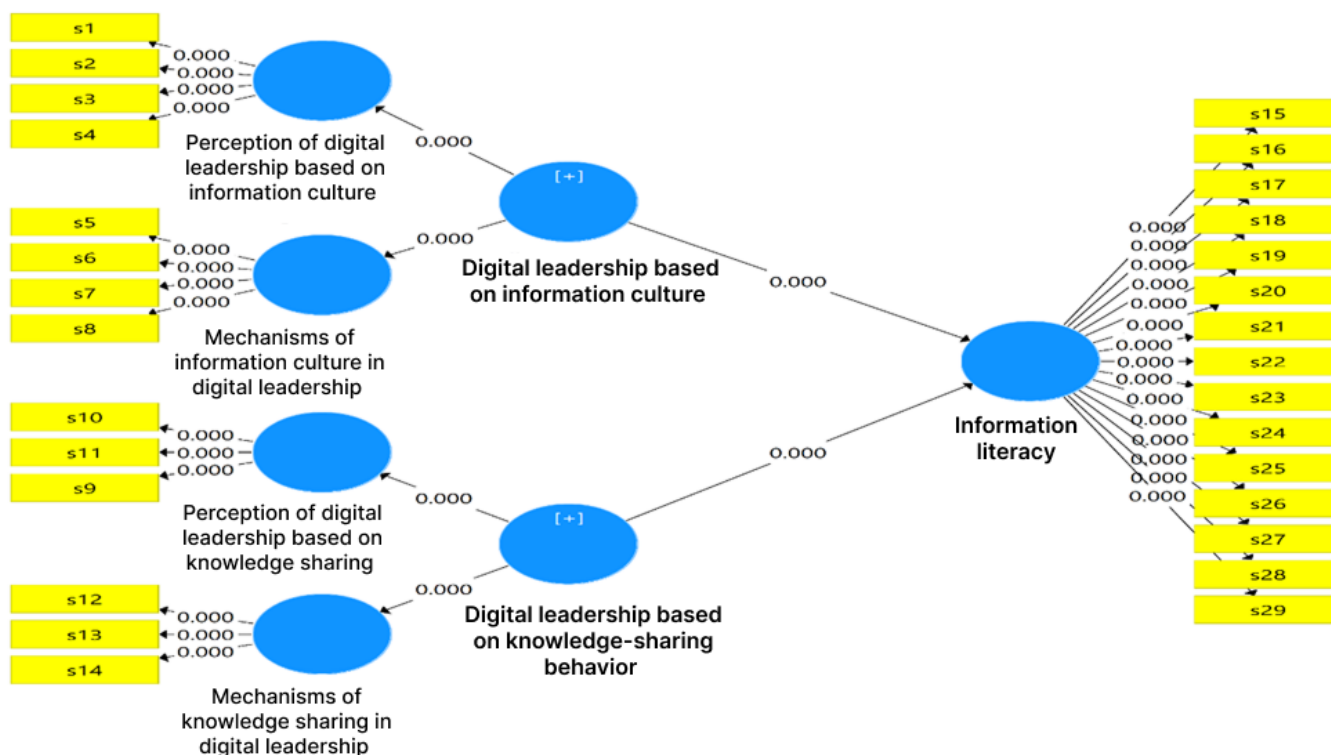


Figure 3. p-Values of the Research Model

Figure (3) shows the significance levels (p-values) of the study variables. If the probability that the results occurred due to random error is less than 0.05, the results are significant; if greater than this threshold, the results are not significant. Therefore, the existing relationships are confirmed at the 95% confidence level.

Discussion and Conclusion

The findings of this study provide comprehensive insights into the structural relationships between digital leadership based on information culture and information literacy among history teachers in Salah al-Din Province, Iraq. The results from the structural equation modeling (SEM) analysis demonstrated that digital leadership grounded in information culture exerts a direct and significant effect on teachers' information literacy. The results also revealed that the underlying mechanisms of information culture—such as transparency, knowledge sharing, continuous learning, trust-based collaboration, and innovation—serve as important predictors of the development of teachers' digital competence and literacy. This finding suggests that effective digital leaders foster a culture in which teachers not only use technology but also develop the cognitive and cultural capacities necessary to engage with information critically and effectively (1, 17).

The confirmatory analysis indicated that organizational transparency, continuous learning, and trust-based cohesion are strong components of digital leadership that significantly enhance teachers' ability to seek, evaluate, and apply information. This aligns with the idea that digital leadership transforms not only technical infrastructure but also human and cultural systems

within educational environments (3, 5). The teachers who work under leaders promoting open communication and information sharing reported higher levels of digital literacy, suggesting that the culture of transparency acts as an enabler of digital empowerment. Similarly, when leaders adopt trust-based and participatory practices, they encourage teachers to engage more actively in collaborative knowledge construction, which in turn strengthens their ability to integrate digital tools into the teaching-learning process (12, 13).

Another important result of the study concerns the mechanisms of digital leadership, specifically the integration of advanced technologies, flexible structures, and system-based transparency, all of which had significant positive effects on teachers' information literacy. The results confirm that leaders who develop digital strategies and institutional frameworks consistent with the principles of information culture can facilitate the development of digital competence among their staff (1, 2). These findings are consistent with the theoretical perspectives of digital transformation, which emphasize that technological adaptation in education depends on leadership that fosters cultural and cognitive readiness rather than focusing solely on infrastructure (6, 7). Moreover, the path coefficients obtained from the SEM model suggest that digital leadership grounded in information culture accounts for a substantial proportion of the variance in information literacy, reinforcing the importance of leadership as a mediating factor in digital education systems.

The Delphi method, used to validate and refine the thematic dimensions of digital leadership, also supported these findings by demonstrating strong expert consensus regarding the significance of knowledge-based culture, innovation orientation, and accountability as key dimensions of digital leadership. Experts emphasized that when educational leaders adopt digital technologies while maintaining a culture of transparency and collaboration, teachers become more confident in using technology for research, teaching, and professional development (4, 8). The study's model reliability tests—such as KMO, Bartlett's Test, and Cronbach's alpha—also confirmed the internal consistency and construct validity of the research framework, suggesting that the constructs of digital leadership and information literacy are conceptually intertwined.

The results can also be interpreted through the lens of transformational and knowledge-based leadership theories, which highlight the leader's role in empowering employees through shared vision, intellectual stimulation, and support for innovation (9, 17). The evidence from this study aligns with prior research showing that transformational leaders promote a digital learning culture by motivating staff to adopt new technologies and experiment with digital teaching tools (12, 13). Teachers who perceive their leaders as digitally competent and supportive tend to show higher levels of information-seeking behavior, improved problem-solving skills, and greater confidence in using technology. This reinforces the theoretical proposition that leadership behavior serves as a catalyst for the development of digital literacy.

The study's findings also align with research on authentic and servant leadership, both of which emphasize trust, ethical conduct, and participatory decision-making. The dimension of trust-based cohesion identified in this study resonates strongly with the authentic leadership approach, which builds credibility and psychological safety in digital contexts (14, 15). When teachers perceive their leaders as authentic, transparent, and responsive, they are more likely to engage in collaborative information sharing and use digital platforms effectively. Similarly, servant leadership, which prioritizes empowerment and service to others, has been shown to improve employee performance and engagement through the enhancement of communication networks and digital collaboration (11). The consistency between the present results and prior leadership theories underscores that effective digital leadership transcends managerial authority; it is fundamentally relational and ethical in nature.

Another significant implication emerging from the results concerns the role of information culture as a mediating construct. The findings revealed that information culture mediates the relationship between digital leadership and information literacy by creating an environment conducive to continuous learning and innovation (3, 5). In such environments, teachers are not passive

recipients of digital tools but active participants in the co-creation of digital knowledge. The evidence suggests that the establishment of a robust information culture—characterized by openness, accountability, and data-driven decision-making—is a prerequisite for successful digital transformation (2, 4). These results are consistent with earlier studies highlighting that leaders who encourage data transparency and participatory practices facilitate the emergence of knowledge ecosystems within their organizations (16).

The correlation results also demonstrated that information-sharing mechanisms—such as collective participation, organizational accountability, and culture-oriented transformation—are closely related to the enhancement of information literacy. Teachers who participated in schools with higher levels of collective participation and accountability reported greater self-efficacy in managing digital resources. This outcome supports findings by Novitasari and Cahyono (2024), who emphasized that leadership style and IT adoption jointly influence knowledge-sharing intentions within organizations (18). Likewise, Ahmadi and Saffari (2024) demonstrated that knowledge-based leadership positively affects organizational performance through the mediating role of customer knowledge management and innovation quality (17). By analogy, digital leadership based on information culture can improve educational performance by enhancing teachers' cognitive and technological capacities through continuous information sharing.

Moreover, the findings affirm that continuous learning plays an integral role in sustaining digital competence. In organizations where leaders establish systems that support ongoing professional development, teachers show higher adaptability and confidence in digital environments (8, 12). This finding echoes Montazeri and Esmaili's (2023) argument that transformational leadership reduces organizational inertia and fosters adaptability to technological change (13). Similarly, the digital learning environment must be characterized by innovation and psychological safety, enabling educators to experiment with technology without fear of failure (10). Such conditions stimulate innovative behavior, which is a critical determinant of long-term digital sustainability in educational institutions (9).

The positive and significant relationship between digital leadership and teachers' information literacy also corroborates the broader findings in the field of digital education transformation. Zhu (2023) emphasized that leadership in the Web 3.0 era must go beyond administrative oversight and focus on digital empowerment and infrastructure development to foster information literacy among teachers and students (5). Similarly, Yao et al. (2023) demonstrated that the success of digital transformation depends on achieving strategic consensus among leaders and stakeholders regarding digital innovation (1). The results of the current study thus extend this understanding by confirming that leadership grounded in information culture provides the contextual framework necessary for digital literacy to thrive in educational settings.

These findings also contribute to the growing body of knowledge linking digital leadership to sustainable and ethical organizational practices. Abdeldayem and Aldulaimi (2024) argued that sustainable leadership integrates digital and ethical dimensions to balance efficiency with inclusivity and social responsibility (16). The current study supports this argument by demonstrating that digital leadership emphasizing fairness, accountability, and transparency leads to greater information accessibility and equitable knowledge distribution among teachers. This suggests that sustainability in digital education is not merely a technological outcome but a leadership-driven process that integrates human values into digital systems.

Furthermore, the study supports the theoretical view that digital transformation is inherently human-centric. The emotional and cognitive readiness of teachers to engage with technology is significantly influenced by the leadership environment in which they operate. Leaders who address digital anxiety, promote collaboration, and encourage mutual trust enable teachers to develop both the technical and psychological dimensions of information literacy (4). These findings are consistent with evidence showing that digital leadership must balance the efficiency of technology with human empowerment to ensure long-term institutional development (1, 2).

Overall, the results of this research confirm that digital leadership based on information culture plays a pivotal role in enhancing information literacy among educators. The significant structural relationships found in the study highlight the necessity for educational leaders to adopt comprehensive digital leadership models that integrate technological strategy, information culture, and human empowerment. By fostering an environment characterized by transparency, collaboration, and learning, digital leaders can drive both technological adoption and professional growth in educational systems.

Despite its contributions, this study has certain limitations that must be acknowledged. First, the research was conducted among history teachers in Salah al-Din Province, Iraq, which may limit the generalizability of the findings to other regions or disciplines. Cultural, infrastructural, and policy differences may influence the dynamics between digital leadership and information literacy in other educational contexts. Second, while the mixed-methods approach allowed for comprehensive analysis, qualitative data were limited to 14 interviews, which may not fully capture the diversity of teachers' experiences. Additionally, the study relied on self-reported data, which are subject to social desirability bias and individual interpretation. Finally, as digital transformation is a rapidly evolving process, longitudinal research would be needed to capture changes in digital leadership practices and their long-term impact on teachers' information literacy.

Future studies could explore comparative analyses across different educational levels, such as primary, secondary, and higher education, to assess whether the relationship between digital leadership and information literacy varies by institutional context. Researchers may also expand the model by incorporating mediating or moderating variables such as digital anxiety, organizational innovation, or teacher motivation. Conducting longitudinal studies would provide deeper insights into the causal mechanisms and sustainability of digital leadership effects over time. Cross-cultural studies could also reveal how national policies, digital infrastructure, and educational cultures influence the implementation of information-based leadership models. Finally, future research might employ advanced analytical tools such as artificial intelligence or big data analytics to examine large-scale patterns of digital competence development among teachers.

For educational administrators and policymakers, the findings highlight the need to prioritize leadership development programs that integrate digital competencies with ethical and collaborative skills. Schools and education ministries should provide continuous professional development opportunities focusing on digital pedagogy, data literacy, and collaborative technology use. Educational leaders should cultivate an open culture where teachers are encouraged to share experiences, experiment with new tools, and participate in decision-making regarding digital initiatives. Finally, institutions should invest in digital infrastructure and create feedback mechanisms to ensure that technological innovations align with teachers' actual needs and educational goals, thereby promoting a sustainable and inclusive digital learning environment.

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Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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References

1. Yao Q, Tang H, Liu Y, Boadu F. The Penetration Effect of Digital leadership on Digital Transformation: The Role of Digital strategy Consensus And diversity Types. *Journal of Enterprise Information Management*. 2023;37(3):903-27. doi: 10.1108/jeim-09-2022-0350.
2. Kusanke K, Pilgenröder S, Kendziorra J, Winkler TJ, editors. *Digital Leadership in the Public Sector: Towards a Public Sector Digital Leadership Competency Model*. Twenty-ninth Americas Conference on Information Systems; 2023.
3. Sung W, Hong. *Information Technology in/and Education*. Advances in educational marketing, administration, and leadership book series 2023.
4. Salam A. Navigating the Digital Landscape: Exploring the Interplay of Digital Leadership, E-Learning Anxiety, and Innovative Behavior. *Journal of Digitovation and Information System*. 2023;3(1):32-46. doi: 10.54433/jdiis.2023100020.
5. Zhu H. Research on the Construction of University Education Informationization Leadership in WEB3.0 Era. *Journal of Education Humanities and Social Sciences*. 2023;22:883-8. doi: 10.54097/ehss.v22i.14557.
6. Ghofrani A, Khanifar H. Digital Transformation in the Teaching-Learning Process; Assessing the Digital Competence of Student-Teachers. *School and Educational Studies*. 2020;9(3).
7. Miboodi H, Saeedi A, Vakili J, Mirsaedi H. Explaining the Criteria and Components of Digital Competence for Instructors in the Educational Environment of Future Schools. *Journal of Exalted Education*. 2023;3(3):1-12.
8. Daniëls E, Hondeghem A, Dochy F. A Review on Leadership and Leadership Development in Educational Settings. *Educational Research Review*. 2019;27:110-25. doi: 10.1016/j.edurev.2019.02.003.
9. Aditya A, Roby S, Giovanni J. The Influence Of Transformational Leadership And Work Motivation On Employee Performance With Information Technology Adoption As A Moderating Variable. *Jurnal Manajemen Sains dan Organisasi*. 2024;5(1):21-31. doi: 10.52300/jmso.v5i1.13206.
10. Sharif S, Tongkachok K, Akbar M, Iqbal K, Lodhi RN. Transformational leadership and innovative work behavior in three-star hotels: mediating role of leader-member exchange, knowledge sharing and voice behavior. *VINE Journal of Information and Knowledge Management Systems*. 2024;54(1):1-21. doi: 10.1108/VJIKMS-07-2021-0122.
11. Khan F, Arshad M, Raoof R, Farooq O. Servant leadership and employees' performance: organization and information structure perspective. *The Service Industries Journal*. 2024;44(11-12):832-50. doi: 10.1080/02642069.2022.2086976.
12. Purwanto A, Fahmi K, Sulaiman A. Linking of transformational leadership, learning culture, organizational structure and school innovation capacity: CB SEM AMOS analysis. *Journal of Information Systems and Management (JISMA)*. 2023;2(3):1-8.
13. Montazeri L, Esmaili N, editors. *The Impact of Transformational Leadership Style on Organizational Inertia in the Education Department of Qaemshahr County*. The 8th National Conference on New Approaches in Education and Research; 2023; Mahmoudabad, Mazandaran.
14. Farrokhi M, Amiri Z. Investigating the Impact of Authentic Leadership on Employees' Organizational Trust (Case Study: Charities in Isfahan City). *Biannual Journal of Research on Philanthropy and Charitable Studies*. 2023;1(2).

15. Kikha Z, Nasti Zaee N. The Impact of Authentic Leadership on the Effectiveness of School Management with the Mediating Role of Knowledge Sharing. 2020.
16. Abdeldayem MM, Aldulaimi SH. Sustainable Leadership and Sustainability: Insights from the GCC. Information and Communication Technology in Technical and Vocational Education and Training for Sustainable and Equal Opportunity: Education, Sustainability and Women Empowerment: Springer Nature Singapore; 2024. p. 401-11.
17. Ahmadi R, Saffari H. The Effect of Knowledge-Based Leadership on Company Performance According to the Mediating Role of Customer Knowledge Management and Innovation Quality. Dynamic Management and Business Analysis. 2024;2(4):13-20. doi: 10.22034/dmbaj.2024.2022216.1009.
18. Novitasari D, Cahyono BT. Leadership Style and Information Technology Adoption on Knowledge Sharing Intention: A Structural Equation Modelling (SEM) Partial Least Square Approach. International Journal of Social and Management Studies (IJOSMAS). 2024;5(1).