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Impact of digital leadership on users' technology integration and digital transformation

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ABSTRACT

Objective: This study examines the effects of digital leadership (DL) on digital transformation (DT), with users' technology integration (TI) as a mediating variable, drawing on resource-based theory (RBT) and the Technology Acceptance Model (TAM).
Method: A quantitative survey design was employed. Data were collected from 397 teachers, vice principals, heads of faculty, and lead teachers working in charter schools in Abu Dhabi and analysed using structural equation modelling.
Results: The findings indicate that DL has a significant impact on DT as well as on users' technology integration. Furthermore, technology integration significantly mediates the relationship between DL and DT. DL functions as a strategic organisational resource that drives school-level DT and enhances teachers' integration of technology. The application of RBT and TAM demonstrates that perceived usefulness and perceived ease of use are shaped by leadership support, which in turn affects actual technology adoption.
Contribution: This study provides empirical evidence that digital leadership plays a critical role in facilitating technology integration and digital transformation, particularly in schools. The findings also offer valuable insights for improving educational outcomes and supporting charter schools in leveraging digital technologies to address future challenges.

Introduction

Digital transformation (DT) is a firm-level organisational change that signifies the disruptive implications of digital technology for businesses (Blanka et al., 2022; Gilli et al., 2024). The COVID-19 crisis accelerated the adoption of digital technologies, propelling businesses several years ahead in their DT processes (Biron et al., 2021). During the COVID-19 crisis, various digital technologies were utilized to modify, replace, and enhance industry standards, as well as to establish new frameworks and practices. Consequently, scholars have analysed the factors that influence successful DT. Digital transformation is a complex and multidimensional strategic management process involving teachers' technology integration, operations, and people (Lokuge et al., 2019; Porfírio et al., 2021; Yao et al., 2024). Leadership capabilities and characteristics significantly affect the success of DT initiatives (Gyamerah et al., 2025; McCarthy et al., 2024). This situation presents new leadership and management challenges for supervisors and managers across all sectors and industries (Benner & Waldfogel, 2023; Hanelt et al., 2021). Therefore, in today's era, which is driven by technological innovation and disruption, digital transformation requires effective digital leadership (DL).

Digital leaders play an important role in implementing the strategies that lead to DT. DL guides the DT process by ensuring the effective coordination of activities and people to achieve organisational objectives at both the strategic and operational levels (Dióssy et al., 2025; Schiuma et al., 2024). This is a critical factor in enhancing digital work. Digital leaders facilitate DT through forward-thinking perspectives, adaptability, and a commitment to change, which are key for driving cultural transformation in challenging environments (Porfírio et al., 2021; Yao et al., 2024). In the workplace, they effectively utilise digital tools that are beneficial to the organisation and its operations (Carbonara & Basile, 2025) and identify opportunities to extract value from the use of digital technologies (Gledson et al., 2024).

Information and communication technology (ICT) is essential for facilitating the social, economic, and educational transitions that characterise contemporary knowledge societies (Wang & Zhao, 2021).

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Research on ICT integration has become increasingly important for understanding how teachers adapt and apply these tools in the classroom (Beardsley et al., 2021), use technology to prepare lessons, teach in class, assess learning and provide feedback, and communicate enhanced teaching methods (Chen et al., 2024) as well as emphasise individual needs and incorporate them into curricula (Martzoukou et al., 2020). However, in education, teachers' knowledge and effective technology integration remain the primary obstacles to successful DT (Hämäläinen et al., 2021).

To overcome such barriers, countries worldwide have prioritised national ICT education policies, including digital learning frameworks in the European Union and extensive one-to-one device programs in nations such as South Korea and Singapore (Sailer et al., 2021). The goals of the Centennial 2071 projects, alongside the UAE Vision 2021, have directed attention toward digital integration in education (Ministry of Education [MoE], 2020). However, implementation remains uneven, and ICT integration has largely been confined to public schools. By contrast, charter schools in Abu Dhabi have successfully integrated advanced technologies to enhance learning and administrative processes, demonstrating an effective DT model (Abu Dhabi Department of Education & Knowledge, 2025). This combination makes the learning process more engaging and enjoyable.

Organisations that incorporate DL into strategy planning are better positioned to innovate, adapt, and succeed in digitally driven environments (Erhan et al., 2022). Successful DT depends on a digital leader's ability to support employees' adaptation to ongoing digital change (Müller et al., 2024). Although scholars have highlighted the importance of DL in DT, several limitations remain. Existing studies have primarily focused on leaders' attitudes and abilities related to ICT (Boccoli et al., 2024; Van Wart et al., 2019). Therefore, this study examines the strategic role of digital leaders and the role of school teachers as enablers through technology integration in successfully implementing DT.

From a strategic perspective, DL is perceived as an organisation-level orientation that aligns direction, capability development, and execution to deliver DT. DL behaviours enable creativity, open innovation, and digital transformation (Ahmed et al., 2018, 2024; Naqshbandi & Tabche, 2018). Leaders' practices in schooling have been linked to digital change, including in the UAE context (Blaik Hourani et al., 2021). DL has also been associated with improved communication, trust, and innovation (Islam et al., 2025). Despite this, existing studies rarely specify the influence of DL on school-level DT, and the underlying mechanisms that translate DL into DT outcomes remain unclear. To address this gap, DL is conceptualised as a strategy-centred orientation, and its direct impact on school DT, as well as its indirect impact through teachers' technology integration (TI), is examined. By exploring these relationships, this study provides insights into how charter schools utilise advanced technology to improve their learning outcomes and prepare students for life in the modern world.

This study makes several contributions to the literature on DL, users' technology integration, and DT. Specifically, it investigates these variables as potential drivers of DT in UAE charter schools. This study also examines the mediating role of teachers' technology integration, thereby providing an understanding of the mechanisms underlying school DT. Furthermore, it provides theoretical and practical implications for policymakers and school principals aimed at enhancing the effective use of technology and guiding charter schools towards successful DT. Finally, the findings highlight the importance of aligning school-level strategies with broader governmental goals and initiatives for digital education, thereby supporting Sustainable Development Goal 4 (quality education) and preparing schools to remain resilient and adaptable in the face of future disruptions in information technology.

Theoretical background

Resource-based theory

According to resource-based theory (RBT), long-term competitive advantage arises from the effective use of valuable, rare, inimitable, and non-substitutable resources (Rupeika-Apoga et al., 2022). DL serves as an enabler for deploying and coordinating critical institutional resources—such as digital infrastructure, workforce, and organisational functions —to promote innovation in teaching and learning within higher education institutions (Borah et al., 2022; Chand & Tarei, 2021). DL articulates a clear vision for digital adoption, fosters an innovative culture, and allocates resources towards the development of educators' and students' digital competencies. In this context, RBT provides a theoretical framework for understanding how digital leaders transform available resources into strategically integrated capabilities that enhance instructional quality and institutional agility.

This is particularly relevant in the UAE, where educational institutions have made substantial investments in technological infrastructure. For example, institutions in Abu Dhabi have deployed centralised learning management systems, data analytics tools, and cloud-based platforms through targeted leadership initiatives (Abdelfattah et al., 2023). Despite growing scholarly interest in DL, existing research has often examined these mechanisms in isolation or has primarily focused on Western contexts. Evidence from non-Western countries, particularly in the Arab world, remains limited. Therefore, studies integrating RBT, DL, and teachers' technology integration (TI) to examine their combined influence on school DT in the UAE charter schools are needed to advance understanding of these relationships within the UAE context.

Technology acceptance model

The Technology Acceptance Model (TAM) is a widely accepted framework for explaining individual technology adoption behaviour. It is based on two key constructs: perceived usefulness (PU) and perceived ease of use (PEOU). These constructs explain why and how digital technologies are used in teaching practices within learning environments (Hämäläinen et al., 2021; Tondeur et al., 2021). Teachers are likely to adopt technology when they perceive it as enhancing their teaching effectiveness and being easy to use. In this study, TAM serves as the theoretical foundation for examining technology integration (TI). According to TAM, external variables—such as leadership, training, and organisational support—influence teachers' perceptions of technology, which in turn affect their actual technology use. DL enhances PU and PEOU by establishing clear expectations, promoting professional development, and supporting the development of digital infrastructure (AlNuaimi et al., 2022; Porfírio et al., 2021). When such leadership support is present, teachers are more confident and motivated to engage in meaningful technology integration. This study demonstrates how incorporating TAM into the research framework extends the model to leadership-supported decision-making related to TI, thereby contributing to DT outcomes more broadly. Furthermore, the study reinforces the validity of TAM-based educational research and contextualises it within digitally developing school systems in the UAE.

Literature review and hypotheses development

Globally, the digital era has significantly reshaped business operations, requiring organisations to adjust and operate within a competitive landscape (Cao et al., 2025; Lu et al., 2023). When organisations strategically leverage data and analytics, they can drive innovation and

enhance user experiences (Porfírio et al., 2021), thereby adding value to both organisational processes and customer experiences (Hanelt et al., 2021) through the integration of digital technologies across business functions and the transformation of digital governance.

Digital expertise is a prerequisite for effective digital leadership across sectors and industries (Bresciani et al., 2021). However, educational systems tend to digitalise more slowly than other sectors (Amankwah-Amoah et al., 2021), with overall low levels of digitalisation reported in education (Kumi-Yeboah et al., 2023). The rapid and continuous digital transformation of higher education necessitates a strong role for DL across multiple dimensions, including vision, strategy, power delegation, staff development, pedagogy, organisational culture, and technological resources. This role is particularly critical for managing online and blended learning environments (Abdelfattah et al., 2023).

Digital leadership is essential for DT due to digital leaders' visionary approaches to change, as well as their flexibility and agility in capitalising on emerging opportunities (AlNuaimi et al., 2022). Digital leaders focus on empowering, supporting, and motivating followers to use technology effectively by adopting top-down communication strategies and providing clear guidance (Dióssy et al., 2025; Probojakti et al., 2025). They facilitate mindset shifts, guide product and process innovation activities, and develop operational strategies such as cost leadership and product differentiation (Mahroof et al., 2025; Tuyen et al., 2025). Furthermore, digital leaders deploy managerial capabilities to coordinate organisational resources, creating adaptive contexts that enable the integration of new digital knowledge-based resources with existing ones (Gilli et al., 2024; Müller et al., 2024). Despite this, limited empirical evidence exists regarding which specific DL practices most strongly contribute to DT success and which strategic activities leaders should adopt to ensure smooth and effective transitions (Porfírio et al., 2021; Zia et al., 2024).

ICT is widely recognized as a critical driver of social, economic, and educational change (Iivari et al., 2020). Integrating technology into education can lead to substantial transformations in instructional practices by enabling greater interaction between teachers and students (Wang & Zhao, 2021). Technology also plays a vital role in reducing administrative tasks—such as grading and record-keeping—thereby allowing teachers to devote more time to high-quality instruction (Guggemos & Seufert, 2021). Effective ICT integration requires a balanced understanding of the relationship between technology and pedagogical content, ensuring that neither dominates the other (Celik, 2023). The Technological Pedagogical Content Knowledge (TPACK) framework proposed by Baran et al. (2019) outlines the knowledge teachers require to integrate technology effectively in pedagogy (Al-Adwan et al., 2025). The model identifies the technological, pedagogical, and content knowledge necessary for teachers to manage complex instructional roles (Celik, 2023). Nevertheless, Baran et al. (2019) highlighted the challenges teachers face in integrating these domains successfully, highlighting the urgent need for additional support.

Digital leaders integrate digital tools into end-to-end organisational operations and ensure consistent user experiences across multiple channels (Carbonara & Basile, 2025). In educational settings, the effective integration of instructional technology supported by DL significantly enhances student outcomes, demonstrating the strong capabilities of DL in this sector (Erhan et al., 2022). School principals are required to assume the role of digital leaders to integrate technology effectively into core instructional practices (Seufert et al., 2021). Similarly, school leaders should model and demonstrate effective technology use within administrative routines, thereby facilitating more flexible technology adoption across schools (Lee & Fanguy, 2022). Despite this, empirical evidence on principals' direct impact on the effectiveness of technology integration remains limited (Lai et al., 2022). Accordingly, this study examines the pivotal role of DL in facilitating the integration of technology within educational settings, focusing on key methods and actions that enhance instructional practices.

Digital leadership and digital transformation

Digital leaders act as catalysts for DT by combining visionary leadership with digital competencies to foster organisational innovation and adaptability (Borah et al., 2022; Gilli et al., 2024). From an RBT perspective, dynamic capabilities constitute strategic resources that enhance an institution's ability to leverage digital resources effectively, thereby securing a competitive advantage (Majumdarr et al., 2024). DL is therefore essential for achieving digital maturity, as capable digital leaders can identify critical digital skills, align strategic objectives with technological capabilities, and embed a digital culture within their organisations (AlNuaimi et al., 2022; Porfírio et al., 2021). They promote clarity, develop digital talent, facilitate collaboration, and integrate new technologies into organisational processes (Bellis et al., 2024; Fatima & Masood, 2024). In educational contexts, digital leaders act as advocates and facilitators, communicating a shared understanding of digital readiness and reducing resistance among stakeholders (Erhan et al., 2022; Yang et al., 2025). Therefore, this study proposes:

H1. Digital leadership has a significant influence on school DT.

Digital leadership and technology integration

DL empowers teachers to adapt, learn, and integrate DT effectively into their instructional practices. This empowerment fosters a climate of digital innovation, enabling teaching teams to develop and successfully implement innovative ideas into their practice (Majumdarr et al., 2024). Wang and Zhao (2021) demonstrated that DL enhances communication and engagement around technology, thereby facilitating the seamless assimilation of DTs and practices. This supports the view that digital leaders are responsible for providing training, resources, and ongoing support. In educational settings, the influence of DL is reflected in teachers' willingness and competence to integrate technology into pedagogical practices (Yang et al., 2022). Teachers who are confident and encouraged to use digital tools are more likely to integrate them in ways that enhance learning outcomes. Chen et al. (2024) found that effective teacher technology integration is positively associated with student engagement and academic performance. Furthermore, school-based digital leaders act as change agents, positively influencing teachers' technology integration practices (Kali et al., 2019; Masry-Herzallah & Stavissky, 2023; Richardson et al., 2021). Hämäläinen et al. (2021) further emphasised that teachers' digital competence and experience are critical for successful technology integration, with DL playing a key role in developing and sustaining these capabilities. By leading professional development initiatives and supporting instructional innovation, digital leaders directly affect the extent to which teachers integrate technology into classroom practice. Therefore, this study proposes:

H2. Digital leadership influences teachers' technology integration.

Technology integration and school digital transformation

Technological advancements are reshaping how students learning and transforming teaching and learning processes (Celik, 2023; Iivari et al., 2020). However, technology alone does not guarantee DT in schools unless it is effectively integrated into teaching practices. Teachers must enhance their digital capabilities (Hämäläinen et al., 2021) to create learning environments that prepare students for the demands of the 21st century (Rolf et al., 2019). Many teachers find it challenging to implement technology-rich problem-solving pedagogies, underscoring the need for pedagogy-driven ICT integration (Tondeur et al., 2021). The post-pandemic context, alongside rapid advancements in artificial intelligence (AI) and related technologies, has further intensified the need for innovative learning methods (Hofer et al., 2021). Although technology use among educators—particularly younger teachers—has increased, technology integration without corresponding

cultural or pedagogical change is unlikely to be effective (Boccoli et al., 2024). Erhan et al. (2022) identified ineffective technology integration as one of the primary barriers to successful school DT. Additionally, high failure rates in DT initiatives are often attributed to limited staff involvement (Ren & Chowdhury, 2025), highlighting teachers' dual roles as both end users and change agents. Consequently, TI is argued to drive school DT by shifting technology adoption from isolated practices to strategic, system-wide educational innovation. Accordingly, this study proposes:

H3. Teachers' technology integration influences school DT.

The mediating role of teachers' technology integration

Digital leaders play a critical role in guiding organisations through the complex DT process by employing mechanisms that strategically align institutional resources to achieve a competitive advantage (AlNuaimi et al., 2022). Within this context, TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are the two core beliefs influencing individuals' intentions to use technology (Kamal et al., 2020). DL plays a pivotal role in shaping these perceptions and can be as influential as personal experience. School principals influence PU and PEOU by providing digital resources, facilitating professional development opportunities, and articulating a clear vision for digital integration (AlNuaimi et al., 2022; Porfírio et al., 2021). In the absence of adequate leadership support, teachers may resist integrating DT despite their availability (Erhan et al., 2022; Hämäläinen et al., 2021). Drawing on TAM, this study conceptualises teachers' technology integration as a process-oriented behaviour shaped by PU and PEOU. This perspective provides a theoretical explanation for how DL influences DT outcomes. Accordingly, this study proposes:

H4. Teachers' technological integration mediates the relationship between DL and DT.

Methodology

Participants and data collection

Using a quantitative research design, this study examines the relationship among DL, TI, and DT in charter schools within the Emirate of Abu Dhabi. An online questionnaire was developed and reviewed for clarity and content accuracy before distribution. The survey was administered to staff members of 36 Abu Dhabi charter schools across various educational levels, including kindergarten and Cycles 1, 2, and 3 (Fig. 1).

The survey was distributed via official email to a non-random selection of respondents. Participants were required to have at least three years of experience working under the same school principal. The target population comprised primary teachers, heads of faculty, lead teachers, and vice principals employed in Abu Dhabi charter schools. A total of 750 individuals were invited to participate, of whom 360 completed the survey, resulting in a response rate of 48 %. A multi-stage sampling technique was employed. In the first stage, purposive sampling was used to select charter schools located in the Emirate of Abu Dhabi. The researcher contacted the Abu Dhabi Department of Education and Knowledge (ADEK) to obtain ethical approval and permission to collect data; ADEK provided the official email addresses of the selected charter schools. The researcher then contacted these schools via their official email accounts. Relevant administrative personnel forwarded the survey to school principals, who subsequently distributed it to faculty members. Participation was voluntary, and responses were collected anonymously. Within the purposively selected schools, convenience sampling was used to recruit individual teachers and school leaders.

Demographically, the majority of participants were teachers (73.1 %), with lead teachers, heads of faculty, and vice principals representing the remaining groups (see Table 1). A substantial proportion (33.0 %) reported having 15 or more years of professional experience. Most participants (91 %) held either a bachelor's degree or a master's degree. In terms of gender, female respondents (71.8 %) outnumbered male respondents (28.2 %). The largest age group comprised participants aged 30–39 years (48.0 %), followed by those aged 40–49 years (31.1 %), with smaller proportions in the younger and older age groups.

Measurement

The questionnaire consisted of 31 items adapted from previously validated instruments and measured using a 5-point Likert scale. The five-item DL scale was adopted from Erhan et al. (2022). Higher scores indicated stronger DL practices as demonstrated by school principals. A sample item is: "Our school is staffed with professionals skilled in using new IT developments to allow us to provide a rich learning environment". Technology integration was measured using a 21-item scale

Table 1
Demographic information.

Category	Sub-category	Frequency	Percentage
Position	Vice principal	17	4.5
	Head of faculty	34	8.9
	Lead teacher	54	14.1
	Teacher	277	72.5
Experience	1–5 years	58	15.3
	6–10 years	102	26.9
	11–15 years	94	24.8
	>15 years	125	33.0
Qualification	Diploma	25	6.6
	Bachelor's degree	234	61.7
	Master's degree	111	29.3
	PhD	9	2.4
Sex	Male	106	28.0
	Female	272	71.8
	23–29	41	10.8
Age	30–39	182	48.0
	40–49	118	31.1
	≥50	38	10.0

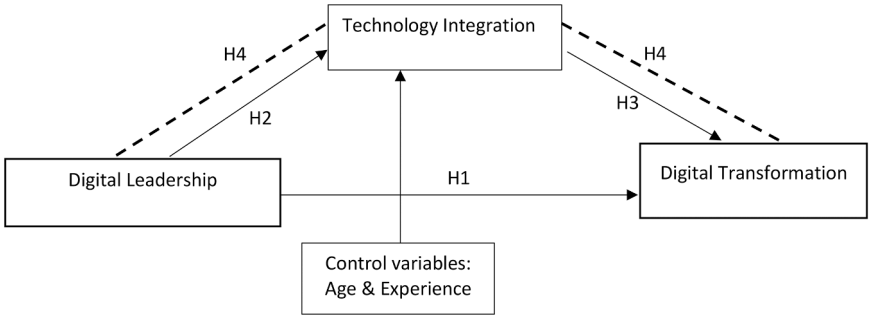

Fig. 1. Conceptual framework.

adapted from Yeh et al. (2014). Sample items include: "I am able to use different technology-infused instruction to assist students with different learning characteristics". Higher scores reflected a greater ability to integrate ICT across instructional processes. DT was measured using a five-item scale developed by Nasiri et al. (2020). Higher scores indicated greater levels of DT maturity within schools. A sample item is: "In my school, we aim to achieve information exchange with digitality". The full list of measurement items is provided in Appendix A.

Control variables

Age and professional experience were included as control variables, as they are commonly used to examine differences in technology integration among users. Prior research has demonstrated that age influences ICT utilisation, with older individuals often exhibiting higher levels of computer anxiety (Šabić et al., 2022). Additionally, prior experience has been demonstrated to significantly affect individuals' willingness to adopt new technologies (Blut & Wang, 2020). Accordingly, both age and experience were controlled for in the analysis.

Data analysis

Reliability and validity testing

As reported in Table 2, descriptive statistics indicate that respondents reported high levels of DL ($M = 4.08$, SD=0.76), TI ($M = 4.20$, SD=0.61), and DT ($M = 4.10$, SD=0.68). These high mean values suggest that participants perceive themselves or their organizations as exhibiting strong digital leadership, engaging in extensive technology integration, and making substantial progress in DT. All variables demonstrated high reliability scores, where DL=0.91, TI=0.98, and DT=0.91. In addition, the constructs also had strong discriminant validity, as all AVE values exceeded the recommended 0.50 threshold (DL=0.734; TI=0.693; and DT=0.739). Correlation analysis demonstrated that all constructs were positively and significantly associated. Digital Leadership was moderately correlated with Technology Integration ($r = 0.588$, $p < 0.01$) and Digital Transformation ($r = 0.647$, $p < 0.01$). Technology Integration demonstrated a strong correlation with Digital Transformation ($r = 0.791$, $p < 0.01$). These significant positive correlations suggest that stronger DL is related to higher levels of TI and DT. The strongest relationship was observed between technology integration and digital transformation, which aligns with theoretical expectations that effective technology use facilitates digital change.

Confirmatory factor analysis and common method bias

As the study relied on self-reported data, common method bias (CMB) was assessed following the procedures recommended by Podsakoff et al. (2012). Three CFA models were estimated to evaluate potential CMB and to validate the underlying measurement structure. Both Model 1 and Model 2 demonstrated poor fit. Where Model 1 was a single-factor model with all items loaded onto one latent factor, and Model 2 was a two-factor model. However, as theorized by Model 3, the theoretically grounded three-factor model showed excellent fit to the data ($\chi^2/df = 2.594$, CFI = 0.967, TLI = 0.962, RMSEA = 0.065), indicating that CMB was unlikely to pose a significant concern and confirming the appropriateness of the proposed factor structure. Overall, the CFA results support the theoretical relationships among the constructs, illustrating the impact of DL on DT, with TI as a mediating mechanism within the school context.

Results and discussion

Results

The results of the statistical analysis support all four hypotheses (see Tables 3 and 4). For H1, the relationship between DL and school DT was positive and statistically significant, with a path coefficient of $\beta = 0.647$ ($p < 0.001$). This finding suggests that DL plays a critical role in facilitating DT in schools. For H2, DL exerted a significant positive effect on TI ($\beta = 0.588$, $p < 0.001$). For H3, TI demonstrated a strong and significant positive influence on DT ($\beta = 0.791$, $p < 0.001$), suggesting that greater adoption of technology by teachers in both pedagogical and administrative activities substantially enhances schools' DT.

For the mediation hypothesis (H4), AMOS was used to estimate the standardised total, direct, and indirect effects, along with bootstrap confidence intervals, to examine the mediating role of TI. The results indicate a strong relationship between TI and school DT, as evidenced by a positive coefficient of 0.70, demonstrating that effective TI significantly contributes to enhancing school DT. DL also had a positive impact on school DT, although to a lesser extent ($\beta = 0.25$). In addition, a positive relationship was observed between DL and TI ($r = 0.47$), suggesting that effective DL supports improved TI. These findings imply that the influence of DL on DT primarily operates through its role in enabling teachers to utilise technology in practical and meaningful ways. Table 4 presents the standardised direct and indirect effects of DL, TI, and school DT, along with the results of the bootstrap significance analysis. The direct effects analysis revealed that DL had moderate and relatively minor effects on TI (0.472) and school DT (0.251), respectively. In contrast, TI exerted a strong direct effect on school DT ($r = 0.704$). With the mediator included in the model, the effect of DL on TI increased to 0.588 ($p = 0.004$) and remained statistically significant, as did its effect on schools' DT (0.278, $p = 0.003$). Teachers' technology integration continued to have a substantial impact on schools' DT ($r = 0.627$, $p = 0.009$). These results indicate partial mediation in the relationship between DL and DT through TI, while no mediation was observed between DL and TI (see Fig. 1b).

Control variables

Pearson's correlation coefficients were calculated to examine the extent to which the control variables affected TI as a mediating factor. The results revealed a weak and non-significant correlation between age

Table 3
Hypothesis testing results.

Hypothesis	Relation	Standardized Estimate (Beta)	t-value	Significance (p-value)	Accepted/ Rejected
H1	DL → DT	0.647	16.48	<0.001	Accepted
H2	DL → TI	0.588	14.12	<0.001	Accepted
H3	TI → DT	0.791	25.08	<0.001	Accepted

Table 2
Descriptive statistics, standard deviation, reliability, and correlations.

Variable	Mean	SD	AVE	Composite Reliability	1	2	3
Digital Leadership (1)	4.08	0.76	0.734	0.451	0.908		
Technology Integration (2)	4.20	0.61	0.693	0.964	0.588**	0.978	
Digital Transformation (3)	4.10	0.68	0.739	0.516	0.647**	0.791**	0.910

Note: Reliability scores are at the diagonal.

Table 4
Standardised direct and indirect effects between DL, DT, and TI with two-tailed bootstrap significance analysis.

Parameter	Direct (without Mediator)	Direct (with Mediator) Two-Tailed Bootstrap Significance Analysis				Indirect
		Estimate	Lower	Upper	*p*-value	
DL–TI	.472	.588	.339	.611	.004	.000
DL–DT	.251	.278	.134	.393	.003	.332
TI–DT	.704	.627	.540	.821	.009	.000

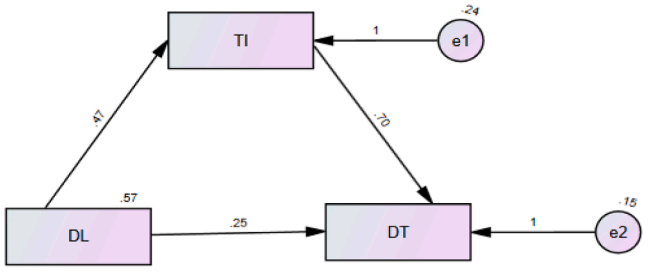

Fig. 1b. Structural model.

and TI ($r = 0.014$, $p = 0.788$). In contrast, teaching experience demonstrated a small but statistically significant positive correlation with TI ($r = 0.112$, $p = 0.029$), indicating that more experienced teachers were slightly more inclined to integrate technology into DT. Accordingly, experience was controlled for in the hypothesis testing.

Discussion

This study examined the relationship between the DL of school principals, teachers' roles in TI, and their combined impact on DT within Abu Dhabi's charter school system. One of the study's main contributions is the conceptualization of DL as a strategic organizational direction rather than a collection of individual characteristics. This perspective highlights how DL integrates vision, capability development, and governance mechanisms to enable schools to adopt advanced technologies effectively. As a result, schools can enhance learning outcomes and better prepare students for the demands of a digitally driven world.

The findings demonstrate that DL positively influences DT in schools, underscoring the strategic importance of leadership in coordinating complex organizational goals. While this result aligns with existing research (Dióssy et al., 2025; Schneider & Kokshagina, 2021), the present study extends this body of knowledge by providing empirical evidence from the UAE educational context, moving beyond the predominantly business-oriented focus of prior studies. In charter schools, DL manifests not merely as a driver of operational efficiency but as a "pedagogical vision" that fosters teachers' digital development through clear guidance and strategic alignment of technology use with broader school objectives. This finding supports earlier research emphasising the role of school leaders in translating digital policies into classroom practices by creating opportunities for teachers to develop digital competencies (Dexter & Richardson, 2020; Horner et al., 2019).

Furthermore, the study identified a strong relationship between DL and TI, suggesting that DL operationalises and facilitates technology adoption by enabling shared practices and collective agency among teachers—an essential prerequisite for successful DT. These findings are consistent with prior literature highlighting the importance of clear communication, task alignment (Brock & von Wangenheim, 2019; Probojakti et al., 2025), and the modelling of effective technological behaviours to promote collaboration and shared use of technological tools (Navaridas-Nalda et al., 2020). In contrast to many business organisations, where DT initiatives often fail due to a neglect of the human element (Ren & Chowdhury, 2025), this study reinforces the importance of positioning educators as the central enablers of technological change. Teachers with higher levels of digital literacy play a particularly important role in advancing DT (Lai et al., 2022), as they tend to feel more empowered and committed to schools' transformation goals (AlNuaimi et al., 2022; Bag & Wood, 2022).

Finally, the findings indicate that both DL and TI are significant predictors of DT in charter schools, suggesting that TI complements the strategic efforts of DL in driving school-level DT. DL provides overarching vision and direction, while TI ensures effective implementation within classrooms, creating a synergistic relationship between leadership and faculty engagement. This result aligns with previous studies emphasising the critical role of DL (Dióssy et al., 2025; Erhan et al., 2022; Müller et al., 2024; Porfírio et al., 2021; Schiuma et al., 2024; Yao et al., 2024) and supports Håkansson Lindqvist's (2019) argument that synergy between administrative leadership and teaching staff is essential for sustained impact. By framing DL as a strategic organizational direction rather than an individual trait, this study offers practical insights for UAE school leaders and educators, encouraging a focus not only on technology acquisition but also on strategic integration of people and processes to prepare students for a technology-driven future.

Theoretical implications

This study contributes to the DL literature by adopting a strategic, organisation-level perspective, rather than focusing primarily on individual leader traits or technical skills. It extends existing models of leadership in digital contexts by conceptualising DL as encompassing goal setting, capacity building, and effective management, thereby offering a broader framework for understanding how leadership drives DT. The findings demonstrate that DL influences DT both directly and, potentially more effectively, through complementary mechanisms such as teachers' technology integration. In doing so, this study advances leadership and educational technology research and paves the way for future theoretical models that integrate strategic leadership perspectives with technology adoption frameworks in educational settings.

Drawing on RBT, this study positions DL as a strategic resource that facilitates TI and school DT. According to RBT, organisations achieve sustained advantage by leveraging valuable, rare, inimitable, and non-substitutable resources (Rupeika-Apoga et al., 2022). In the educational context, DL plays a critical role in supporting teachers' integration of technology into instructional practices. Teachers' digital competencies represent a key component of human capital, influencing the success of TI and ultimately contributing to long-term DT (Navaridas-Nalda et al., 2020). This analysis highlights how DL strategically mobilises resources—including human capital, infrastructure, and institutional support—to enhance schools' digital capabilities. In UAE charter schools, leadership-driven resource allocation positively influences the effective digitalisation of educational activities. RBT therefore offers a valuable perspective on understanding how institutions develop digital capabilities over time. With strong DL, schools are better positioned to leverage professional development initiatives, infrastructure investments, and institutional resources to support sustainable transformation (Cabellos et al., 2024). Consistent with this perspective, Dexter and Richardson (2020) demonstrated that leadership strategies substantially affect the pace and depth of technology integration in schools.

In addition to RBT, this study employs the TAM (Davis, 1989) to explain how teachers' attitudes shape technology integration. Digital leaders influence these attitudes by providing training, ongoing support, and clear communication regarding the use of digital tools (AlNuaimi et al., 2022; Porfírio et al., 2021). TAM therefore complements RBT by elucidating the connection between leadership practices and teachers' behavioural responses, emphasising how DL enhances TI by influencing psychological and behavioural processes. Together, these theoretical

perspectives explain how DL facilitates both the structural alignment of digital resources and educators' willingness to engage with technology, thereby supporting effective and sustained DT.

Conclusion, policy implications, and future recommendations

Conclusion

This study examined the effects of DL on DT through the mediating role of users' TI in the UAE educational context. Drawing on RBT and TAM, the findings indicate that TI significantly mediates the relationship between digital leadership and digital transformation. The key takeaway is that DL functions as a strategic capability that enables teachers to integrate technology into everyday practices, thereby contributing to successful and sustainable DT in schools.

Policy implications

This study offers important implications for government regulators, school leaders, and teachers, particularly in the context of ongoing DT in education. First, national educational authorities should establish clear standards and structured training programs for DL. These should define the competencies required for school leaders to effectively guide DT efforts, including strategic planning, communication, and innovation management. Second, ministry officials and charter school leaders should expand opportunities for professional learning in digital pedagogy, enabling educators to develop practical digital competencies. Such initiatives should emphasise strategies for integrating technology into everyday teaching routines in ways that enhance efficiency and free time for other essential activities, such as curriculum alignment, workflow development, and the attainment of micro-credentials. Third, national monitoring and evaluation systems should be implemented at the local school level to assess progress in DT. These systems should systematically track leadership practices, technology usage, teacher competencies, and the effectiveness of TI in instructional practices. Regular monitoring of these indicators can support evidence-based policy-making, inform school-level interventions, and ensure alignment between digital transformation initiatives and broader educational goals. Finally, fostering communities of practice across charter schools can accelerate DT by facilitating knowledge sharing, dissemination of best practices, collaborative innovation, and leadership development. Regular showcases of high-impact TI initiatives can further sustain momentum and support continuous improvement across the charter school system.

Limitations and future research

As with most empirical studies, this research has several limitations. First, the study focused exclusively on charter schools; therefore, the findings should be generalised cautiously to public and private schools within the UAE, given potential institutional differences. Future research should include a broader range of school types to enhance generalisability. Second, data were collected using an online questionnaire with a cross-sectional design, which limits the ability to establish causal relationships or capture changes over time. Although appropriate analytical measures were employed, causal inferences could not be confirmed. Future studies should adopt multi-level and longitudinal research designs to explore the dynamic and evolving nature of DL, TI, and DT. Further research examining the implementation of DL in educational settings could strengthen DT initiatives. In particular, a deeper investigation into technology adoption processes and teacher engagement may yield valuable insights for enhancing instructional practices. To support effective DT, schools should also conduct regular evaluations to address infrastructure and regulation-related challenges. Additionally, future studies should explore other factors influencing school-level digital transformation, such as access to technology, institutional support, and variations in teachers' digital skills.

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CRediT authorship contribution statement

Salma Mousabbeh AlDhaheri: Writing – original draft, Conceptualization, Data curation, Formal analysis, Project administration. **Muhammad Faisal:** Supervision, Writing – original draft, Writing – review & editing. **Rohit Sharma:** Supervision, Writing – review & editing.

Appendix A. The measurement scale items

Construct	Measurement items	Resources
Digital Leadership (DL)	**DL1**: My school principal raises teachers' awareness at school about the risks of information technologies **DL2**: My school principal raises teachers' awareness of the technologies that can be used to improve the school processes **DL3**: My school principal determines the required ethical behaviours for information implementation with all the stakeholders **DL4**: My school principal plays an informative role in reducing the resistance toward innovations brought by information technologies **DL5**: My school principal shares their own experiences about technological opportunities that will increase the contributions to colleagues for the structure of the learning organization.	Erhan et al. (2022)
Teachers' Technology Integration (TTI)		Yeh et al. (2014)
Using information and communication technology to understand students (TTI- **US**)	**TTI-US1**: I know how to use information and communication technology to know more about students **TTI-US2**: I know how to use information and communication technology to identify students' learning difficulties **TTI-US3**: I am able to use different technology-infused instruction to assist students with different learning characteristics	
Using information and communication technology to understand subject content (TTI- **UA**)	**TTI-UA1**: I am able to use information and communication technology to better understand the subject matter **TTI-UA2**: I am able to identify the subject topics that can be better presented with information and communication technology	
Planning information and communication technology -infused curriculum (TTI- **IC**)	**TTI-IC1**: I am able to evaluate factors which influence the planning of an information and communication technology-infused curriculum	

(*continued on next page*)

(*continued*)

	TTI-IC2: I am able to design technology-infused lessons or curriculum **TTI-IC3**: I am able to identify what types of technology-infused curriculum designs can be used to solve teaching objectives that are difficult to achieve	
Using information and communication technology representations to present instructional representations (TTI-**IR**)	**TTI-IR1**: I select appropriate information and communication technology representations **TTI-IR2**: I use appropriate information and communication technology representations to present instructional content **TTI-IR3**: I am able to use appropriate information and communication technology representations to present instructional content	
Employing information and communication technology-integrated teaching strategies (TTI- **TS**)	**TTI-TS1**: I am able to indicate the strategies which are appropriate for use with information and communication technology-integrated instruction **TTI-TS2**: I am able to apply appropriate teaching strategies in technology-integrated instruction	
Applying information and communication technology to instructional management (TTI- **IM**)	**TTI-IM1**: I am able to indicate the advantages and disadvantages of information and communication technology on instructional management **TTI-IM2**: I am able to use information and communication technology to facilitate instructional management	
Infusing information and communication technology into teaching contexts (TTI- **TC**)	**TTI-TC1**: I am able to indicate the differences between the contexts of information and communication technology-infused teaching to the contexts of traditional teaching **TTI-TC2**: I am able to use information and communication technology to facilitate the achievement of teaching objectives **TTI-TC3**: I am able to indicate the influences of different information and communication technologies on instruction **TTI-TC4**: I am able to indicate substitute plans for technology-infused instruction	
Using information and communication technology to assess students (TTI- **AS**).	**TTI-AS1**: I know the different types of technology-infused assessment approaches **TTI-AS2**: I am able to identify the differences between technology-integrated assessments to traditional assessments **TTI-AS3**: I am able to use information and communication technology to assess students' learning progress.	
Digital Transformation (DT)	**DT1**: In my school, we aim to digitalize everything that can be digitalized **DT2**: In my school, we collect large amounts of data from different sources **DT3**: In my school, we aim to create more robust networking with digital technologies between the different learning processes **DT4**: In my school, we aim to enhance an efficient teachers' interface with digitality. **DT5**: In my school, we aim to achieve information exchange with digitality	Nasiri et al. (2020)

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Glossary

Digital leadership: refers to the application and adoption of leadership strategies that align with the contemporary digital era and rely on advanced technological platforms (Bresciani, 2021). Digital leaders, known for their enthusiasm and comprehensive approach, are well-positioned to spearhead these integration initiatives, which are supported by teams that are at the vanguard of this revolution (Carbonara & Basile, 2025).

Digital transformation: refers to the process by which an organization undergoes a fundamental shift in its operations, adopting and integrating various technological advancements, such as big data, analytics, cloud computing, mobile communication technologies, and social media platforms. This transformation enables the company to enhance its ability to deliver goods and services to its stakeholders (Brockb & Wangenheim, 2019).

Teachers' technology integration: means the integration of technologies for teaching and learning and pertains to employing digital technology to intellectually stimulate and actively involve students in various learning activities. The primary determinant is not contingent upon the specific technological device or the frequency of its utilization (Wang & Zhao, 2021).

Charter schools: constitute the third model of education in the Emirate of Abu Dhabi and are the product of an unprecedented collaboration between the private and public sectors. This partnership supports the national agenda of the United Arab Emirates to establish a competitive, sustainable, and knowledge-based economy while fostering an extraordinary worldwide interchange of experiences (ADEK, 2025).