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Enhancing faculty members' technology-enhanced teaching practices through leadership

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There is an emerging consensus that technology-integrated practices are an effective approach to teaching and learning in higher education. However, despite the substantial investment in technology as an instrument to help teachers and students in an effective manner for higher education, the faculty members are not maximizing the potential of these resources. Through interviews with eight faculty members and three deans from second-tier colleges in Zhejiang, the study explores key factors influencing technology integration and effective leadership strategies for enhancing faculty members' technology-enhanced teaching practices within second-tier colleges of Chinese higher education institutions. Findings reveal that faculty members' technology integration is shaped by intrinsic factors, such as personal goals and willingness to innovate, and extrinsic factors, including access to resources, funding, time, organizational culture, and leadership support. Specific leadership strategies emerged as critical, including setting clear technology goals, providing professional development opportunities, fostering a collaborative culture, and offering incentives such as funding and recognition for innovation. Based on these findings, the study proposes a leadership impact model on technology integration, emphasizing the importance of tailored approaches that address both institutional and individual barriers. Policy recommendations include allocating dedicated funding for technology initiatives, ensuring equitable access to resources, and promoting inter-institutional collaboration to leverage expertise. The findings demonstrate the efficacy of leadership strategies for technology integration in aligning with and extending the Technology Acceptance Model (TAM) and the Path-Goal Theory within the unique context of Chinese higher education.

KEYWORDS

higher education, leadership practice, technology acceptance model, technology integration, path-goal theory

1 Introduction

Technology integration, including AIGC-assisted instruction, has become a cornerstone of effective teaching and learning in higher education, offering personalized learning, accessibility, and improved cognitive engagement (Ahmed, 2020; Alsalhi et al., 2021; Li and Liu, 2022; Liesa-Orús et al., 2020; Martin et al., 2022; Pregowska et al., 2021). They can also help students stay connected with their teachers and peers, solve academic challenges (Rapanta et al., 2020). Despite its benefits, their utilization of it remains constrained and auxiliary (Alieto et al., 2024; Tsegay et al., 2022) and there is a lack of organic integration of those tools into curriculum-based activities (Liu and Xiao, 2025). The extent of integration is hindered by factors such as educators' limited use of ICT and a lack of alignment with curricula (Peng et al., 2024). Leadership plays a pivotal role in overcoming these barriers, as principals and administrators significantly influence technology adoption among faculty (A'mar and Eleyan, 2022; Chang, 2012). Studies highlight that strong technology leadership enhances teachers'

ICT literacy and institutional digital transformation (Celep and Tülübas, 2014), yet empirical research on higher education remains scarce (Zhang, 2022).

In China, technology leadership research has primarily focused on K-12 settings, with limited exploration in higher education (Zhang, 2022). Given deans' critical role in resource allocation and faculty development, understanding their leadership practices is essential for fostering technology integration (Liu, 2022). However, there is a paucity of research on technology leadership in higher education institutions in relation to research topics, conceptual definitions, and research methods (Yuting et al., 2022). This study investigates:

> RQ1: What factors influence faculty members' technology integration?
>
> RQ2: How can leadership practices enhance technology integration?

By examining faculty perceptions of deans' leadership, this research aims to inform decision-making, improve technology adoption, and contribute to higher education's digital transformation, ultimately benefiting institutional and societal growth.

2 Theoretical framework

2.1 The path-goal theory

Technology leadership theory is rooted in the path-goal theory of leadership, which emphasizes a leader's role in clarifying goals, removing obstacles, and providing support to facilitate subordinates' success (House and Mitchell, 1975; Northouse, 2016). With the rise of ICT in education, this theory evolved to highlight how leaders must guide, incentivize, and align faculty efforts with institutional objectives (Priyowidodo, 2021). Effective technology leadership encompasses four key behaviors:

Directive Leadership—Leaders articulate a clear vision for ICT use, providing structured guidance on implementation.

Supportive Leadership—Leaders foster a collaborative environment, advocating for ICT adoption while prioritizing faculty wellbeing.

Participative Leadership—Decision-making is shared among administrators, tech leaders, and educators to promote collective ownership (Mertens et al., 2024; Wang et al., 2022).

Achievement-Oriented Leadership—Leaders cultivate innovation and self-improvement, trusting faculty to meet technological and pedagogical goals (Schmitz et al., 2023).

By integrating these behaviors, leaders can enhance faculty motivation, competency, and effective technology integration in education.

2.2 Technology acceptance models

Another framework guiding this study is the Technology Acceptance Model (TAM). It is based on earlier behavioral theories, namely the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB). The concept was initially developed by Davis et al. (1989) and described the decision to adopt technology as a result of a decision maker's attitude toward computer use (Davis et al., 1989). Drawing on self-efficacy theory, the theory of reasoned action, and cost–benefit analysis, Davis et al. (1989) argued that two main factors influence users' attitudes toward adopting and implementing technologies and their practices: perceived ease of use and perceived usefulness (see Figure 1). Perceived usefulness refers to the extent to which the individual finds the technology useful in performing their work. Perceived ease refers to the extent to which individuals can learn the technology without much effort. The model has been extensively tested in a variety of contexts and found to be robust. In general, the stronger an individual's perceived ease of use, the more readily they can learn the technology and related knowledge (Al-Adwan et al., 2024b). When individuals perceive the usefulness of technology or certain knowledge, they tend to be more proactive in learning them.

3 Literature review

3.1 Factors influencing technology integration

Effective technology integration in education fundamentally depends on teachers' self-efficacy—their confidence in using technology pedagogically (Anderson and Maninger, 2007)—which

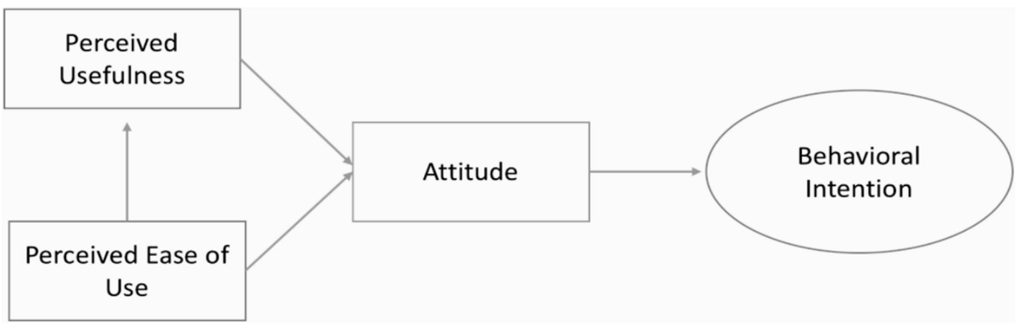

FIGURE 1
Technology acceptance model (Davis et al., 1989).

stems from Social Learning Theory and significantly impacts both teaching practices and student outcomes (Bandura, 1994; Barton and Dexter, 2020). While professional development plays a crucial role in building this confidence through collaborative skill-building (Karasavvidis and Kollias, 2014; Kiili et al., 2016), its effectiveness is often undermined by inadequate leadership support that frames technology as burdensome rather than empowering (Karakose et al., 2021). Beyond self-efficacy, successful integration requires technological pedagogical content knowledge (TPACK) and positive perceptions of technology's instructional value (Grundmeyer and Peters, 2016; Hartman et al., 2019), highlighting the need for sustained professional development, supportive leadership, and an innovative culture (Raman and Thannimalai, 2019; Rapanta et al., 2020).

Research also identifies multifaceted barriers spanning personal, institutional and technological dimensions, including time constraints, inadequate training, resource limitations, leadership factors, and teachers' pedagogical beliefs (Al-Adwan et al., 2024a; Ertmer et al., 2012). These challenges manifest globally, with studies categorizing obstacles as resource-related (equipment, access), expertise-based (training, confidence), systemic (institutional support), and belief-driven (perceived value) (Hew and Brush, 2007). The Chinese context reveals similar patterns, highlighting internal barriers (teacher reluctance, capability gaps) and external constraints (organizational dynamics, technological infrastructure) (Wang, 2018; Xu et al., 2015). Ultimately, these impediments coalesce into three overarching categories: personal subjective factors (attitudes, self-efficacy), external objective factors (resources, policies), and individual characteristics (skills, creativity), presenting a complex challenge requiring holistic, context-sensitive solutions (Ericson Alieto et al., 2024; Zhang and Fang, 2022).

3.2 technology leadership and leadership effectiveness

Research consistently identifies school leadership as the pivotal factor in successful technology-driven instructional transformation (Porter and Graham, 2016), with principals' decisions and actions directly influencing both teacher practices and student outcomes (Hallinger, 2011). Effective technology leadership requires principals to demonstrate multiple competencies, including ICT proficiency (Schmitz et al., 2023), visionary planning (Chang, 2012), and the ability to foster cultural shifts toward creative learning paradigms (Tonich, 2021). Studies demonstrate that principals' technological competencies significantly predict technology utilization school-wide (Afshari et al., 2008), with transformational leadership behaviors particularly enhancing teachers' adoption of digital tools (Schmitz et al., 2023; Yamamoto and Yamaguchi, 2019). This leadership effectiveness manifests through four key dimensions: establishing clear technological visions, providing infrastructure support, implementing evaluation systems, and demonstrating strong communication skills—all while navigating budget constraints and staff development needs (Chang, 2012; Zhao and Zhao, 2016).

While existing studies have established the importance of discrete competencies like ICT proficiency, significant gaps remain in understanding how multiple leadership competencies (visionary planning, faculty empowerment, innovation support) collectively influence leadership effectiveness (A'mar and Eleyan, 2022). Current research has predominantly focused on isolated skills rather than examining their interactive effects or relative predictive strengths on learning outcomes. This partial understanding underscores the need for comprehensive investigations that simultaneously assess various technology leadership competencies and their differential impacts, particularly in diverse educational contexts. Future research should develop more holistic models that account for the complex interplay between leadership competencies, school culture transformation, and measurable improvements in teaching and learning outcomes through technology integration.

3.3 Technology leadership in Chinese higher education

The majority of existing literature related to the technology leadership in higher education is focused on Chief Information Officers (CIOs) as the primary subjects of investigation (Zhang, 2022). It has been well accepted in Chinese higher education that CIOs should advocate for technology application, integrate professional technical services with institutional strategic goals and measure outcomes (Arnold and Sangrà, 2018). But there is still no consensus among scholars regarding the concept of technology leadership in higher education (Liu, 2022). According to Zhang (2017), it is a subset of leadership, which refers to the capacity of leaders to influence and guide faculty, students, staff, and stakeholders in implementing organizational change and achieving development goals in higher education institutions by utilizing information technology. Several Chinese scholars (Zhang, 2017, 2022; Liu, 2022) have attempted to establish appropriate frameworks for measuring technology leadership in Chinese tertiary institutions in light of ISTE (2018). Wang (2021) proposed that the technology leadership of vocational school principals should include five dimensions: awareness, IT ability, planning, organization and implementation, and leadership effectiveness. Zhang (2017, 2022) considered technology leadership from the perspective of organizational change, and classified the technology leadership behavior into motivational inspiration, change support, planning and design, related project implementation, and outcome assessment. Although faculty members are at the forefront of utilizing technology to promote changes in higher education, acting as the grassroots force toward achieving educational digitization (Zhang and Fang, 2022), the leaders, such as second level college deans, play a pivotal role in the promotion of digitization within a university, acting as the driving force behind it (Liu, 2022).

4 Research methodology

The qualitative semi-structured interviews were employed by combining two modes of interview: face-to-face and online interviews, which were conducted primarily via Tencent video conferencing. In-person interviews permit the investigator to gain a more profound comprehension of the respondents' genuine sentiments. Conversely, online interviews afford respondents greater comfort and control over their self-presentation (Rettie, 2009), thus enabling a more flexible approach to conducting interviews. Before the interview started, participants were asked to review the confidentiality and anonymity protocols, confirming they met the inclusion criteria. Interviews were audio-recorded with permission, and no risks, benefits, or incentives were involved. Participants were assigned unique identifiers, and data were securely stored on password-protected computers with restricted access.

4.1 Subjects

The interviews were conducted among selected faculty members and deans of second-level colleges in government-run higher education institutions in Wenzhou City, China.

Faculty participants for the semi-structured interviews (Table 1) were selected through purposive sampling to ensure diversity in institutional type, education level, gender, and years of experience. Among all the faculty interviewees, five were from the general tertiary institution, and three from the vocational college. The duration of the interviews with faculty members was approximately 60 min, with the shortest lasting 45 min, and the longest lasted 2 h.

With regard to the interviews with deans, the researcher contacted five of them within the institutions where the faculty interviewees are employed. Two of them declined to be interviewed due to their busy schedules or lack of interest. As illustrated in Table 2, the deans demographically and institutionally represent a diverse range of backgrounds and types of universities. The time for interviews with the deans averaged approximately 70 min, with a range of between 50 min and 2 h.

4.2 Interview protocol

The interviews with the faculty members were conducted in accordance with a structured protocol, which encompassed five distinct areas of questioning: (1) current ICT-curriculum integration, (2) challenges and needed leadership support, (3) effective dean leadership practices, and (4) suggestions for improvement. Similarly, the interviews with the deans were structured around the following five areas of questioning:(1) faculty's ICT integration, (2) faculty challenges and support needs, (3) their own leadership initiatives and perceived impact, (4) obstacles in promoting technology, and (5) reflections on effective leadership practices.

TABLE 2 Summary of the interview participants among deans.

Name	Gender	Years of leadership experience	Type of university
Ben	Male	8	General tertiary institution
Sunny	Female	16	General tertiary institution
Penny	Female	5	Vocational college

4.3 Issues of trustworthiness

In qualitative research, bias is inherent due to the difficulty of controlling all social influences (Noble and Smith, 2015), so we employed several strategies to enhance trustworthiness. A pilot study with faculty members refined interview questions and techniques (Maxwell, 2013), while peer debriefing with research professors helped identify and address potential biases. Multiple coding by an independent researcher improved reliability by verifying themes (Ryan and Bernard, 2003), and member checking ensured participants validated transcriptions and interpretations, enhancing accuracy (Birt et al., 2016). These measures collectively strengthened the study's credibility and fairness.

4.4 Data analysis

The study adopted the six-step thematic analysis framework by Naeem et al. (2023), building on Clarke and Braun (2016) reflexive approach to ensure rigor and minimize bias. The steps were as follows:

1. Data Familiarization: Transcripts were generated and reviewed to identify key themes and salient quotations aligned with the research objectives.
2. Keyword Identification: Recurrent patterns, terms, and participant expressions were systematically extracted to capture core experiences.
3. Coding: Transcripts were iteratively analyzed to derive initial codes, with emerging themes (e.g., personal goals, willingness to adopt technology, policy, organizational culture, learning community, autonomy, assessment, resource support) tracked across interviews.

TABLE 1 Summary of the faculty interviewees (pseudonyms).

Name	Gender	Years of teaching	Level of education	Type of university
Qing	Male	25	Master's degree	General tertiary institution
Cici	Female	9	Doctorate degree	General tertiary institution
Ying	Female	3	Doctorate degree	General tertiary institution
Fang	Female	23	Doctorate degree	General tertiary institution
Fu	Male	23	Doctorate degree	General tertiary institution
Min	Female	22	Master's degree	Vocational college
Yan	Female	21	master's degree	Vocational college
Shuo	Female	22	Master's degree	Vocational college

4. Theme Development: Codes were categorized into broader themes, supported by cross-case comparisons (e.g., faculty vs. deans) to refine interpretations.
5. Concept Refinement: Themes were evaluated for clarity, relevance, and theoretical/practical contribution, ensuring alignment with research goals.
6. Model Synthesis: A conceptual model was developed to integrate findings, concluding the analysis.

The final synthesis logically organized interpretations, linking data to relevant theories.

5 Findings

5.1 Faculty perceptions of factors impacting faculty technology integration

The factors influencing faculty members' ICT integration can be categorized into two main groups: intrinsic and extrinsic.

5.1.1 Personal professional goals

For all of the faculty respondents, they were actually aware of the vision and noticed the value of digitization, but some of them (e.g., Ying, Fang) confessed that the common vision would not motivate them much if such a vision was not related to their personal goals.

As was agreed by most of the faculty members (e.g., Cici, Ying, Fang, Qing, Peng), some faculty members were more inclined to adopt innovative approaches to digitally-enabled teaching, such as those who aspire to participate in teaching competitions (Cici, Ying, Yan, Peng), course evaluations (Fang, Qing, Min, Ben), and those who undertake teaching reforms or course construction projects (e.g., Fu, Sunny).

Ying, Fang, and Fu stated that traditional courses are not inherently problematic, provided that there is no surge of AI or other digitization construction projects around. They also indicated that they had their own research pursuits apart from their teaching responsibilities, with minimal involvement in research related to teaching. Therefore, they did not intend to invest much time in teaching, which would inevitably deprive time away from their research activities. Ying, for example, is a cognitive linguistics researcher with a strong grasp of the subject and well-managed classes. As she confessed, *"I did not see any urgent need to actively focus on the application of information technology, which is not essential for my further career advancement."*

5.1.2 Technological environment

To ensure equality of technology access for all students is also a conducive factor. One case was Qing, who mentioned that "*The student's perspective is also an influencing factor; the student has to be happy to use it. Fortunately, because our students are now internet natives, and the university has fostered an embracing attitudes for students to use mobile phones to interact in class.*" Several respondents mentioned that it is a must to ensure students' equal access to technology resources and tools which can lead to more inclusive and engaging teaching practices that cater to diverse learning needs and styles. Most of them agreed that with the students' equal access ensured faculty members can design their lessons and assignments with the assurance that all students can fully participate and benefit from technology-enhanced learning experiences. As Fang recalled, "*it is fundamental to provide orientation to students so that the students know how to use the learning platform, otherwise the faculty members will have to spend a lot of time responding to technical puzzles.*"

> "*The technological environment, including hardware and software equipment, can be a deciding factor,*" according to Shuo. She mentioned, *"Luckily, the teaching environment at my college is heavily infused with modern educational technology. In addition to our regular multimedia classrooms, the college is now equipped with smart classrooms. The computers in the smart classrooms are then equipped with software that can help faculty members to digitize the teaching environment in the smart classrooms."*

Qing stated that the *Wisdom Tree Learning Platform*, on which his online course is based, has a knowledge map, AI assistant, and other small software and programs, which enable her to carry out the entire process of teaching, assessing, and assigning homework. Furthermore, a VR system, which was among the inaugural batch of first-class virtual simulation experiment systems in the country, developed by other colleges within her university, has a function of full-process assessment, which she integrated into her course teaching. Moreover, as was mentioned by Min, a well-designed technical system can streamline processes, improve access to technology resources, and enhance the overall usability and effectiveness of information technology in teaching. Min posited, "the *empowerment of digital intelligence for teaching and research activities hinges on the creation of an enabling environment*."

5.1.3 Financial and temporal factors

Concurrently, the majority of faculty respondents (including Yuan, Fang, Fu, and Ying) indicated that the integration of ICT into teaching necessitated the allocation of additional financial and temporal resources.

Three faculty members (Min, Fu and Qing) indicated that their faculties provide financial support for faculty members' learning and exchange activities. In contrast, Cici, Fang and Ying reported that their faculties face limitations in their financial support, with faculty members required to utilize their own project funds if they wish to participate in exchange activities. Furthermore, Fang asserted that "*the majority of faculty members are unable to engage in learning and exchange activities due to a lack of funding.*"

Among the eight faculty members interviewed, some expressed that they considered it too troublesome to design the ICT-integrated interactive activities or gamification. Cici and Fang asserted that the entire process of preparing technology-integrated teaching materials is excessively time-consuming. As Ying mentioned, *"most of my colleagues actually are aware of the importance of digital skills, and most of young colleague are also proficient in those skills. But few of us are willing to spend time to integrate technology into our nuanced teaching design."* Fang, Ying, and Fu also expressed a lack of motivation to prepare lessons anew. Min indicated that the construction of a digital exercise bank is a challenging endeavor. As Fu acknowledged, "*tests and assignments in paper form can still work, why bother to prepare for digital tests and assignments, as well as online teaching materials? They require so much time and energy investment.*"

5.1.4 Organizational culture

Cici proposed that for promoting the faculty members' technology integration in teaching, leaders must create ampler room for collaboration of technology integration projects, thus cultivating a culture that values continuous improvement and exploration of new teaching methodologies enhanced by technology. She underscored the significance of fostering individual members' motivation by saying, "*faculty members must be inspired to take the initiative to learn and innovate, and be entitled to fail while experimenting.*" Min, on the other hand, proposes that faculty members be granted a certain degree of autonomy to unleash their passion for innovation and inspire innovation in digital teaching and learning.

Nevertheless, the majority of faculty respondents (e.g., Cici, Fang, Ying) indicated that their leaders do not sufficiently value innovation in teaching. This is identified as the reason that the digitization of instruction had not proceeded as it should have within their faculty. Qing was forthright in stating that *"our faculty members are not excluded from the use of information technology, and many of us are with doctoral degrees, highly educated in this profession, and therefore fully competent to naturally integrate teacher information technology into the teaching ontology and pedagogical research. However, there is a lack of an innovative climate for integrating information technology into teaching."*

5.1.5 Policy orientation

During the interviews, it was found that all the faculty members concurred that policy orientation on both the national and university levels can facilitate the popularity of information technology in teaching and learning. As Ying mentioned, *"It is recommended that the majority of faculty members need to be encouraged, and that encouragement be provided in the form of policies."* Furthermore, Shuo stated that "*the government-guided introduction of* various *types of technology-enhanced curriculum construction at all levels in recent years has been a positive driver for faculty members to implement teaching innovations*." The role of curriculum construction projects was also unanimously agreed upon by all interviewees. Qing provided a personal example of this, stating, "*As I am currently leading the construction of a first-class course in Zhejiang Province, the name of this course is 'A Brief Introduction to Chinese Culture'. The course itself is a massive open online course (MOOC), so we use an online teaching platform called Wisdom Tree to teach it.*" Min also acknowledged that had she not previously declared a blended first-class course project called '*Intercultural Communication*', she would not have used the new platform Xuexitong (a learning platform) and other software in the physical classroom teaching.

> *"With regard to the other extensive basic course such as College English (a non-project-based course), I am responsible for, the department only stipulates a platform (provided by the textbook publisher) for students to study the textbook-related knowledge independently outside the physical classroom. There is no requirement to integrate information technology such as AI and interactive software into the teaching process. Therefore, I do not use any information technology in the offline classroom,"* added Ying.

The data from the faculty members revealed that it is helpful to encourage them to engage in skill-enhancing teaching innovation competitions, apply for relevant online courses, blended demonstration courses, ICT achievement awards and teaching reform projects. For instance, faculty members (e.g., Min, Qing, Ying) indicated that the university has a special fund to support faculty members in developing the VR system and AI-assisted courses, which guides them to utilize the benefits of technology integration. Some faculties (5/8) also mentioned that policies are also needed to better promote the reform of "digitization-based classroom teaching" and the "demonstration of innovative classes," which helps to cultivate the innovative environment according to some respondents (e.g., Min, Yuan).

5.1.6 Learning community

The analysis of the data underscores the significance of addressing faculty members' willingness to learn and adapt to new teaching methods, especially in the context of technology integration in education. Strategies such as providing support, recognizing the impact of experience and attitude, and promoting professional development can help cultivate a positive and proactive approach toward incorporating ICT into instructional design.

Cici proposed that faculty members should be encouraged to participate in exchange programs in accordance with the policy pertaining to technology-enhanced instruction. This would foster a sense of urgency among all members of the academic community regarding the importance of keeping pace with technological developments. Those who embrace change and proactively seek to build their digital competencies are better equipped to adapt to new tools, platforms, and teaching methods.

Qing observed that he is fortunate to have a capable leader who provides unwavering support to faculty members and facilitates their professional development. The leader invites experts to provide guidance whenever the faculty of the college initiates a research or teaching reform project. Regardless of the outcome, the faculty members of the department benefit from the expertise of these experts. Consequently, all parties are highly engaged in digital teaching reform projects, which presents a valuable learning opportunity.

Thus, setting the professional learning goals and promoting a mindset of continuous technology-enhanced professional learning encourages faculty members to stay updated on the latest trends and practices in educational technology, enabling them to leverage innovative digital tools and strategies.

5.1.7 Incentives

The analysis underscores the importance of deans' leadership practices in incentivizing faculty members to integrate ICT into instructional design. By offering a variety of incentives tailored to faculty members' needs and preferences, academic leaders can motivate and support technology integration efforts, especially among those who may be hesitant or resistant to adopting new technologies. Incentives play a crucial role in cultivating a culture of innovation, collaboration, and continuous professional development in technology-enhanced teaching practices, ultimately contributing to the overall quality of education and student learning outcomes.

Some faculty members are not willing to learn and adopt new technologies. For instance, "*senior lecturers who have been teaching for an extended period may be less inclined to utilize modern technology due to a lack of exposure to or appreciation for its value in enhancing teaching effectiveness,*" as was mentioned by Fu.

Cici also posited that the primary personal factor affecting faculty members' integration of ICT into all aspects of instructional design is their willingness to adopt new teaching methods and learn new ideas and techniques. Min made similar statements, *"I actively learn to use such platforms as Xuexitong because I love teaching and my research area is in teaching. Thus, I applied for some technology-afforded courses."* However, some faculty members are not willing to adopt new technologies. For instance, senior lecturers who have been teaching for an extended period may be less inclined to utilize modern technology due to a lack of exposure to or appreciation for its value in enhancing teaching effectiveness. Thus, encouragement and support mechanisms, such as policies promoting technology integration, are recommended to motivate faculty members who are reluctant to adopt new teaching methods. Providing professional development opportunities for faculty members, especially those nearing retirement or holding higher academic titles, can help bridge the gap in their understanding and use of technology in education.

> *"For the lecturers who have been engaged in front-line teaching for an extended period and seldom conducted extensive scientific research to inform their approach to enhancing the effectiveness of teaching and learning, they usually exhibit a tendency to underestimate the value of technology integration in their pedagogical strategies."-Qing.*

The data also highlights the importance of faculty members' long-term career planning and professional growth in influencing their willingness to learn and incorporate new ideas and techniques into their instructional design. Faculty members who prioritize academic progress in their discipline may be less motivated to update their teaching practices with ICT, emphasizing the need for targeted strategies to enhance their engagement with technology integration.

The following forms of incentives have been identified: compensation, benefits, honors and awards, empowerment, training, and title promotion. For instance, several faculty respondents (e.g., Cici, Yuan, Fang, Fu, Qing) proposed the implementation of incentives such as hourly subsidies for course instructors who engage in information technology reform projects. Furthermore, Min proposed that the hourly coefficients of the blended courses could be differentiated from those of the traditional course, which would be well-received by many faculty members. Cici suggested that the faculty should issue relevant teaching requirements and incorporate them into the faculty members' teaching performance assessment. However, Fu proposed that this should be linked to the faculty members' professional title promotion and commendation, as he believed that this would be a more effective motivator for the faculty members. He posited that remuneration might be the most effective means of encouraging optimal utilization.

5.1.8 Mandate or not?

According to the faculty responses, all deans encouraged faculty members to integrate ICT into real-time assessment of student learning where appropriate. The majority of the institutions (6/8) have stipulated the proportion of digital-based process evaluation in evaluating students' course learning. *"The university requires 1:1 for formative and summative evaluation, and the department also has requirements in this regard"* (Cici).

Min further elaborated, "*As I am required to undertake the English course, which is taught by a number of different faculty members, the course team has set out a requirement for the use of Welearn, the designated teaching materials supporting platform, and has stipulated the proportion of grades. Nevertheless, for many courses undertaken by a single individual instructor, the department has granted a great deal of autonomy to the faculty members, and does not have any requirements for the integration of information technology in organizing and managing the physical class.*"

A number of faculty respondents (e.g., Cici, Fang, and Fu) have explicitly stated that they do not integrate technology into the classroom teaching process because it is not required anyway. Both Cici and Fu have emphasized that if there were a mechanism for evaluation by the faculty, more faculty members would integrate ICT into their instructional design. Although two out of three deans (i.e., Sunny, Penny) concurred that ICT should not be a mandatory requirement for all courses or faculty members, the majority of faculty members believed that mandatory initiatives would be more effective.

Four faculty respondents (Fu, Fang, Ying, Shuo) indicated that ICT-integrated instruction might not be suitable for every teacher, particularly those approaching retirement, and that they were unwilling to learn it. Fu posited that some faculty members had deeply entrenched teaching philosophies that were difficult to change. Some faculty respondents (e.g., Fu, Ying) explicitly stated that they did not want any policies to be introduced, as they felt that this would place undue pressure on faculty members. However, the majority of faculty members (e.g., Fu, Fang, Qing, Min) believed that it would be more effective to have a faculty-imposed policy so as to accelerate the promotion of educational digitization in the faculty.

5.1.9 The role of deans

In the interviews, the majority of faculty members concurred that the leadership behaviors of deans have a significant impact on faculty members' TI behavior.

Faculty members emphasized the direct correlation between the efforts exerted by deans and the effectiveness achieved in implementing educational digitization initiatives. This highlights the impact of deans' leadership practices on the successful integration of ICT in teaching and learning. When deans are actively involved and dedicate faculty membered to promoting ICT integration, faculty members are more likely to engage with technology and implement innovative practices in their teaching.

One response is from Qing, who stated, "*The dean is the individual responsible for the implementation of effective educational digitization of the relevant courses within the faculty. Therefore, I believe there is a direct correlation between the effort he expends and the effectiveness he achieves.*"

Ying pointed out that deans typically assume supervisory roles, thereby having the capacity to oversee and ensure that informationizational reforms are not only initiated but also tracked for their effectiveness. Deans have the responsibility to monitor the progress of ICT integration initiatives, provide support and resources as needed, and evaluate the impact of these initiatives on learning outcomes. This supervisory role is crucial in fostering a culture of innovation and continuous improvement in educational practices.

5.1.10 Thematic map of factors influencing technology integration

The following thematic map (see Figure 2) categorizes the intrinsic and extrinsic factors influencing faculty members' technology integration, as identified in the study.

5.1.11 Comparative analysis of faculty perceptions across institutions

Table 3 compares faculty perceptions of technology integration across general tertiary institutions and vocational colleges.

Overall, while there are some similarities in factors like the importance of technological environment, there are differences in areas such as financial support, perception of organizational culture, leadership strategies and roles of deans. In general tertiary institutions, there seems to be a stronger influence of research—focused personal goals on technology integration decisions, and a more common perception of a lack of innovation—promoting culture. In vocational colleges, there is more of an emphasis on faculty autonomy and relatively better financial support for learning activities among the sampled faculty.

5.2 Deans' perceptions of effective leadership practices

Three deans agreed to participate in the interview process (see Table 4 for relationships between deans and faculty members). The three deans participating the interview included one male dean and two female deans. The purpose of the deans' interviews was to understand how the deans perceived the effective leadership practices that could enhance the technology integration of faculty members. It was necessary to listen to the deans and not just the self-serving opinions and perspectives of the faculty members.

5.2.1 Ben

Qing's Dean, Ben, acknowledge the importance of technology plans and goals by stating that "*the creation of clear and comprehensive technology plans that outline goals, strategies, and implementation steps helps to ensure that technology integration efforts are purposeful, systematic, and aligned with the overall objectives of the educational institution.*" He also underscored the importance of setting technology goals for professional learning. He stated, "*By setting technology goals for professional learning, faculty members can identify specific areas for improvement and growth in their use of technology in teaching.*"

Factors Influencing Technology Integration

- Intrinsic Factors
  - Personal Professional Goals
    - Alignment with career advancement
  - Willingness to Adopt New Technologies
    - Openness to innovation
  - Long-term Career Planning
    - Research focus vs. teaching focus
- Extrinsic Factors
  - Technological Environment
    - Access to tools and platforms
  - Financial and Temporal Resources
    - Funding and time constraints
  - Organizational Culture
    - Support for innovation and collaboration
  - Leadership Strategies
    - Policies, incentives, and supervision

FIGURE 2
Thematic map of factors influencing technology integration.

TABLE 3 Comparative analysis of faculty perceptions.

Aspect	General tertiary institutions	Vocational colleges
Personal professional goals	Focus on research and academic advancement; less emphasis on teaching innovation.	More inclined to adopt innovative teaching methods due to practical, skills-based focus.
Technological environment	Access to advanced tools (e.g., VR, AI) but uneven distribution across departments.	Heavily infused with modern educational technology; smart classrooms widely available.
Financial and temporal factors	Limited funding for ICT projects; reliance on personal project funds.	Some financial support for ICT integration, but still constrained by budget limitations.
Organizational culture	Lack of innovative climate; leaders prioritize research over teaching reform.	Greater emphasis on collaboration and experimentation in teaching practices.
Leadership strategies	Policy-driven initiatives (e.g., national projects) but limited faculty-level incentives.	More autonomy granted to faculty; gradual adoption of ICT encouraged.
Role of deans	Deans play a decisive role in driving ICT adoption through modeling and support.	Deans focus on creating a supportive environment but lack resources for large-scale change.

TABLE 4 Relationship chart.

Dean	Faculty member
Ben	Qing
Sunny	Min and Shuo
Peng	Yan

Second, Ben highlighted the importance of cultivating a collective understanding of the value and potential of technology in education, and suggested facilitating faculty empowerment by "*providing access to a range of resources, including training materials, best practices, and innovative teaching strategies*" so that leaders can inspire and empower faculty to explore new technology tools and pedagogical approaches.

Third, improving technological proficiency and experiences should be prioritized, according to Ben. He noted that, "faculty *members are more likely to feel supported and empowered to incorporate technology into their teaching practices, thus driving technology integration efforts.*" And he regarded that "*faculty members may be more inclined to explore and integrate other technology tools and resources into their teaching if they experience the benefits of technology-enabled assessments in providing timely feedback and enhancing student learning outcomes.*"

Fourth, Ben advocated for a culture of innovation and collaboration among faculty members. Ben's college provides incentives for research and teaching excellence, such as linking teaching performance assessments to high-quality curriculum projects, offering research funds, providing financial support for online courses, and promoting teachers who receive teaching innovation awards.

As Ben noted, leaders can facilitate faculty members' effective utilization of technology tools and platforms by modeling in innovation and learning. Ben stated, "*I did not impose a mandate on faculty members to integrate ICT into the classroom, as I was concerned that this would place undue pressure on them. I believe that if I assume a more assertive leadership role, some faculty members will follow suit. It is not a process that can be rushed.*"

In his college, Ben has implemented a system to link the technology-enhanced teaching with faculty members' annual teaching performance assessment. Should a faculty member obtain a high-quality provincial curriculum project, they will be eligible for a three-year period of consecutive A grades (the highest possible grades). Therefore, these are also highly attractive. Concurrently, Ben's college has established research funds with the objective of motivating educators to conduct research on information technology teaching and learning. Furthermore, it has provided financial support for exemplary online courses and has promoted teachers who were awarded the first prize for teaching innovation to the next level of seniority.

Finally, when it came to the general role of deans, Ben posited that deans are best positioned to "*spearhead the digitization of education*," given their intimate familiarity with the vision and professional attributes of faculty members within their departments. For instance, the dean is in a position to centralize resources for the development of the organization and the faculty members, which enables him "*to motivate faculty members to engage in activities that align with the prevailing trends through the internal direction of the college.*"

5.2.2 Sunny

Dean Sunny, the dean of the department where Min and Shuo worked, mentioned that she did not set any technology goals for herself and others in terms of professional learning, but she herself took the initiative to learn from the young and some innovative younger colleagues and used some of the information technology as what the university required for some specific courses. She also opened an online course for the university, which had a policy of funding such LMS-based online courses.

With regard to the role of deans, she provided a more typical explanation, stating that *"the university has already had a very tight grip on this area of ICT empowerment, so I do not want to put too much pressure on the faculty members."* However, as was mentioned by Sunny, "*we generally support the professionally approved group-based technology expenses, but for the individual purchases, we tend to be strict in giving approval.*" Furthermore, she stated that she had shared examples of successful technology integration and lessons learned, which had led to some faculty members adopting these practices. The dean expressed her hope that faculty members would keep up with the times. She encouraged them to share any interesting and helpful technological techniques that they were using. This could entail allowing the aforementioned faculties to demonstrate a class or open class, after which other colleagues would be required to attend and learn from it, as was mentioned by Sunny.

5.2.3 Penny

Penny, Yan's Dean, perceived that the "*deans are burdened with numerous administrative duties and lacked time for ensuring the professional learning.*" And "*some of the faculty here are under pressure to do more research, which takes up a lot of their time.*" And they do not tend to feel the need to take the initiative in learning about technology-enhanced teaching. Thus, to her, "*it is first necessary to raise faculty members' awareness of developing the skills needed to navigate change essential in the rapidly evolving landscape of educational technology.*"

But she also observed that she will not impose the technology integration plan on their faculty members unless there are specific universality-level demands. She postulated that the current level of individual self-confidence and motivation among teachers to integrate teaching and learning with technology in general is insufficient, that funding is also insufficient, and that incentives at the faculty level are difficult to put in place. If there is no demand for the cultivation and declaration of curriculum construction projects, it would be unwise to increase the burden on teachers. It is evident that faculty members in her department have a considerable number of classroom hours, and it remains uncertain whether all faculties can effectively integrate technology into their teaching. However, it can be reasonably assumed that they will attempt to do so when they are interested.

Further, Penny reported that leaders do not quite support the individual device purchase because of the tight budget, and meanwhile she "*valued a lot on of the importance of making discipline-related technology integration plans and the discipline-related training programs.*"

5.2.4 Comparative analysis of deans' leadership styles

Based on the qualitative data provided regarding the impact of deans' leadership practices on faculty members' technology integration competency, with a focus on the leadership styles of deans Ben, Sunny, and Penny (see Figure 3) compares the leadership styles of the three deans interviewed in the study.

Dean Ben emphasizes the importance of creating clear and comprehensive technology plans, setting goals for professional learning, and cultivating a collective understanding of the value of technology in education. His leadership approach encourages faculty members to improve their technological proficiency through access to resources, training, and innovative teaching strategies. By linking technology-enhanced teaching with faculty members' annual

```
Dean Leadership Styles
├── Dean Ben
│   ├── Proactive and incentivization-focused.
│   ├── Links ICT adoption to performance assessments.
│   └── Fosters a culture of innovation and collaboration.
├── Dean Sunny
│   ├── Individualized approach to ICT adoption.
│   ├── Encourages knowledge sharing and experimentation.
│   └── Supports group-based technology expenses.
└── Dean Penny
    ├── Recognizes challenges (e.g., time, funding).
    ├── Emphasizes individual motivation and interest.
    └── Values discipline-related ICT plans and training.
```

FIGURE 3
Comparative analysis of dean leadership styles.

performance assessment and offering incentives for research and teaching excellence, Dean Ben motivates faculty members to integrate technology into their teaching practices. His approach focuses on modeling innovation and collaboration and providing ongoing support and empowerment to drive technology integration efforts.

Dean Sunny takes an individualized approach to technology integration, prioritizing learning from innovative colleagues and utilizing information technology as required for specific courses. While she does not set formal technology goals for herself and others, she supports group-based technology expenses and shares successful integration examples within the department. Her leadership style encourages faculty members to experiment with new technologies and techniques, promoting a culture of continuous learning and knowledge sharing. By facilitating opportunities for faculty members to showcase their technology integration practices, Dean Sunny promotes a collaborative and supportive environment for technology adoption.

Dean Penny acknowledges the challenges faced by faculty members in balancing research responsibilities with professional learning and technology integration. While recognizing the importance of developing technological skills in the evolving landscape of educational technology, she highlights the need to raise awareness and provide support for faculty members' technology integration efforts. Dean Penny refrains from imposing strict technology integration plans but stresses the importance of individual motivation and interest in integrating technology into teaching practices. Despite budget constraints and limited incentives, she values discipline-related technology integration plans and training programs to support faculty members' competency in technology integration.

Furthermore, the leadership practices of deans Ben, Sunny, and Penny have varying impacts on faculty members' technology integration. Dean Ben's proactive and incentivization-focused approach fosters a culture of innovation, collaboration, and continuous improvement among faculty members, leading to enhanced technology integration competency and improved teaching practices. By contrast, Dean Sunny's emphasis on individual learning and sharing promotes a supportive and collaborative environment for technology adoption, contributing to incremental gains in technology integration competency. Dean Penny's recognition of faculty members' challenges and the importance of self-motivation and interest in technology integration underscores the need for awareness-raising and support mechanisms in utilizing technology in teaching practices.

The interviews with deans further verified that the leadership practices of deans play a crucial role in shaping faculty members' technology integration. By providing support, resources, incentives, and opportunities for growth and learning, deans can empower faculty members to embrace technology, enhance their skills, and effectively integrate technology into their teaching practices. A collaborative and supportive leadership approach, grounded in fostering a culture of innovation and continuous learning, is essential for promoting faculty members' technology integration competency and advancing educational excellence in the digital age.

5.3 Comparative analysis of faculty and dean perspectives

A comparative analysis was conducted to examine the similarities and differences between the responses provided by deans and those provided by faculty members in the course of their respective interviews. The comparative analysis allows for a more detailed examination of the interview data, with the aim of identifying a common theme or shared understanding between the two groups. The comparison yielded three themes.

5.3.1 Autonomy

For a practice of autonomy for the faculty members, faculty respondents expressed satisfaction with the relatively democratic approach employed by college or department leaders in gradually promoting the information technology project through the creation of an atmosphere. Cici stated that the institution where she works prioritizes humanistic care and professional growth for faculty members. It merely suggests and encourages some of the faculty members who are willing to try it or move first, in order to minimize anxiety among the other faculty members. As Min observed, the college did not mandate the implementation of the aforementioned initiative; rather, it was a voluntary undertaking. The decision to engage with the initiative was ultimately at the discretion of the individual teacher. Cici indicated that her dean had granted considerable autonomy to faculty members. Min stated, "*I am a conservative person; I do not believe that it is inherently problematic to espouse the concept of reform, but I do not consider it to be an optimal approach.*" It is not necessarily negative to propose reform, but it is important to recognize that reform should be implemented gradually.

Such a perspective echoes well with the deans' practice. Firstly, according to Ying and Fang, both the leadership and faculty members are more concerned about their achievement in research than teaching reform. Both Peng and Ben mentioned the importance of prioritizing personal development goals. During the interviews, it was found that all the deans concurred that digitization orientation on both the national and university levels have already been facilitating the tendency of faculty members' adoption of technology.

It is necessary to note that although two out of three deans (i.e., Sunny and Penny) agreed that ICT should not be a mandatory requirement for all courses or faculty members, the majority of faculty members believed that mandatory initiatives would be more effective. Most of the faculty members (e.g., Fu; Fang, Qing, Cici) appreciated that their deans did not demand them to integrate technology in the nuanced design of physical class. The reasons were as follows: it is "*a personal choice*" (Fu), "when faculty members realize the ICT benefits in teaching" (Qing), *"leaders should be kind rather than pressing"* (Fang), *"Changes could not occur within short periods of time"* (Cici), etc.

5.3.2 Assessment

Dean Ben emphasizes the importance of strategic technology plans and faculty empowerment, highlighting the role of deans in spearheading the digitization of education. On the other hand, Dean Sunny focuses on effective supervisory practices, such as walk-in classroom instruction supervision, and the implementation of incentives linking faculty members' teaching assessments to high-quality curriculum projects and research on ICT teaching and learning. Both deans underscore the significance of clear planning, faculty support, and incentivizing innovation.

Echoing what the two deans said, all the interviewees concurred that the college-level incentive and assessment mechanism could facilitate faculty members' active involvement in teaching information technology innovation. In effect, the majority of faculties (where Fu, Min, Qing, or Cici work) assigned some supervisors to evaluate funded ICT-enabled curriculum projects submitted in accordance with the relevant requirements at the university level.

5.3.3 The dean's role

Two deans, Ben and Peng were of the opinion that the leadership practices of deans play a decisive role, whereas one believed that there is a role, but not a significant one. The extent to which deans can influence the digitization of education is contingent upon the university-level orientation and national policy. This is because deans cannot compel faculty members to engage in activities that they are disinclined to undertake. They tend to believe that technology integration among faculty members was predominantly informed by institutional-level rather than departmental-level directives. This accords well with the quantitative results from the multiple linear regression that the type of university can predictive power in faculty's technology integration competency.

As was reported by most of the faculty respondents (e.g., Min, Fang, Cici), leaders can help overcome potential barriers to utilizing technology effectively in the classroom by providing encouragement, support, and acknowledging the achievements of faculty in technology integration efforts. However, it is still the instructors who decide the full integration of ICT into their teaching.

Concurrently, all the interviewees concurred that "*Navigating at the university level, followed by encouragement at the faculty level*" is of paramount importance. Yuan posited that both the university and faculty level leadership should initially prioritize fostering faculty members' sense of exploration and innovation in teaching and learning. Moreover, Qing underscored the pivotal role of deans in this process, emphasizing the necessity for them to take a proactive and discerning approach to rewards and punishments. She lauded the exemplary leadership of Dean Ben, stating, "*Our dean Ben leads well! He is himself engaged in the integration of information technology in teaching and learning, and one of his blended learning courses has been awarded a national project.*"

Figure 4 illustrates the alignment and divergence between faculty and dean perspectives on how to enhance technology integration.

```
Faculty Perspectives
    ├── Intrinsic Factors: Personal goals, willingness to adopt ICT.
    ├── Extrinsic Factors: Technological environment, financial constraints.
    └── Leadership Expectations: Policies, incentives, and support.

Dean Perspectives
    ├── Strategic Planning: Clear goals and resource allocation.
    ├── Faculty Empowerment: Training, collaboration, and incentives.
    └── Cultural Change: Fostering innovation and continuous learning.

Alignment
    ├── Both emphasize the importance of policies and incentives.
    ├── Both recognize the role of technological environment and resources.

Divergence
    ├── Faculty seek more mandatory policies; deans prefer gradual adoption.
    ├── Faculty focus on personal goals; deans focus on institutional goals.
```

FIGURE 4
Faculty vs. dean perspectives.

5.4 Leadership impact model

To enhance the clarity, this section will present the following figure (see Figure 5) to illustrate the impact of leadership practices on faculty members' technology integration by synthesizing the data above. It highlights the key leadership strategies and their outcomes, as identified in the study.

```
Leadership Practices
    │
    ├── Policy Orientation
    │     └── National/University Policies
    │           └── Encourages ICT adoption
    │
    ├── Learning Community
    │     └── Collaboration & Knowledge Sharing
    │           └── Enhances digital competencies
    │
    ├── Incentives
    │     └── Financial, Recognition, Career Advancement
    │           └── Motivates faculty to adopt ICT
    │
    ├── Autonomy vs. Mandates
    │     └── Gradual adoption vs. Mandatory policies
    │           └── Balances pressure and motivation
    │
    └── Role of Deans
          └── Modeling, Support, and Supervision
                └── Drives cultural change and innovation
Outcomes
    ├── Enhanced Faculty Technology Integration Competency
    ├── Improved Teaching Practices
    └── Positive Student Learning Outcomes
```

FIGURE 5
Leadership impact model on technology integration.

6 Discussion

6.1 Strategic planning: goal setting, actionable planning, motivating

As postulated by the path-goal theory, it is the responsibility of leaders to clearly define.

the objectives, tasks, and actionable plans for technology-enhanced projects (Northouse, 2016). This clarity is essential for ensuring alignment, accountability, and the successful implementation of technology initiatives within the college or department. This lends further.

support to the findings of Helalat et al. (2023), who found that clear leadership direction fosters faculty engagement and collaboration in technology projects, enhancing educational outcomes through fostering confidence, enthusiasm, collaboration, and a shared commitment.

Thus, there should be detailed implementation plans that outline the steps, timeline, and resources required for each phase of the project. These plans should be clearly communicated to all involved stakeholders, including faculty members, administrators, and government bodies responsible for funding and policy support. Moreover, deans should celebrate milestones, recognize faculty contributions, and highlight the impact of technology integration (Manda and Abidin, 2023). Identifying and supporting exemplars—early adopters of tech-enhanced teaching—can inspire peers. However, funding constraints must be addressed through government policies that prioritize financial support, such as grants for infrastructure and training.

6.2 Professional empowerment: professional development, innovative and collaborative culture

Investment in training programs, innovative endeavors, and a collaborative climate is essential to update the pedagogical beliefs and practices of faculty members. Deans should provide professional development through workshops, online platforms, and conference support, as evidenced by Martin et al. (2022), though funding constraints necessitate government-backed grants for such programs. Its significance has been identified by several researchers who emphasized the key role of teachers' attitudes and beliefs about ICT on the extent, methods, and effectiveness of their integration of ICT in the classroom (Ifinedo and Kankaanranta, 2021; Zhao and Frank, 2003). School leaders should provide opportunities for teachers to develop their skills and collaborate with peers, as this can enhance their confidence and ability to integrate technology effectively (Liu and Hallinger, 2018). Beyond access to training, school leaders must create opportunities for skill-building and peer collaboration, which have been shown to boost teachers' confidence and competence in technology integration (Liu and Hallinger, 2018). In fact, shaping pedagogical beliefs through collaborative learning not only strengthens educators' self-assurance but also promotes student-centered practices (Ertmer et al., 2012; Liu and Hallinger, 2018). For optimal impact, training should merge technical upskilling with pedagogical reflection, as expanding teachers' technological expertise has been proven to reshape their beliefs—particularly those aligned with student-centered approaches (Ertmer et al., 2012; Fabriz et al., 2021; Liesa-Orús et al., 2020). Equally critical is cultivating a supportive organizational climate—one that encourages collaboration, mutual respect, and experimentation (An et al., 2025; Blaique et al., 2023). Deans can further motivate faculty by offering funded innovation projects, teaching research grants, and autonomy to experiment with new methods (Arnold and Sangrà, 2018). Finally, sustainable integration is reinforced through peer collaboration, coaching, and shared lesson planning, ensuring that pedagogical growth is both continuous and collective.

6.3 Resource support: distributed leadership, stabilizing funding, integration of resources

The persistent challenges with educational technology platforms and infrastructure underscore the need for deans to implement distributed leadership approaches that incorporate stakeholder feedback while clarifying roles and securing stable funding. An effective strategy involves systematically collecting input from faculty and students to identify technology needs, assess program effectiveness, and prioritize equipment upgrades, as demonstrated by Raman and Thannimalai (2019). For such distributed leadership to succeed, deans must develop and clearly communicate robust methodologies for evaluating the efficacy of technological resources and programs to their staff (Galvis and Carvajal, 2022). This participatory approach ensures more informed decision-making while fostering stakeholder buy-in, particularly when combined with established evaluation frameworks that measure how instructional technology impacts student learning outcomes (Bass, 2021; Macaruso et al., 2020). Financial sustainability remains critical, as successful ICT integration requires ongoing investments in hardware, training, and maintenance (Rana and Rana, 2020). Practical solutions include incorporating technology costs into institutional budgets, pursuing alternative funding through grants and fundraising initiatives, and advocating for university support by presenting evidence-based needs and implementation plans (Balter, 2017). Beyond internal resources, deans should actively seek external partnerships to establish specialized technology centers and experimental bases that can support digital transformation in teaching and research. Together, these strategies—distributed leadership for inclusive decision-making, sustainable funding models, and strategic external collaborations—create a comprehensive framework for overcoming current technological limitations in higher education.

6.4 Policy alignment and infrastructure development: a macro perspective

The data also shows that national and regional policymakers must create an enabling policy environment to accelerate technology integration in HEIs through comprehensive strategic plans with clear roadmaps. Critical priorities include securing sustainable funding for infrastructure (including high-speed internet and modern equipment), maintenance, and upgrades (Tate and Warschauer, 2022), while establishing robust data privacy and security frameworks. Policymakers should foster inter-institutional collaboration and public-private partnerships to leverage combined expertise (Galvis and Carvajal, 2022), alongside promoting digital literacy across curricula to prepare both students and faculty. Strategic incentives like grants and tax breaks can encourage institutional adoption of new technologies, complemented by investments in R&D to maintain innovation leadership. Crucially, policies must ensure equitable student access to technology, regardless of their socioeconomic background, and implement rigorous impact evaluation systems. By enacting these coordinated measures, policymakers can empower deans and higher education institutions to successfully navigate digital transformation while maintaining competitiveness.

7 Conclusion

This study examines the critical factors influencing technology integration in teaching practices and identifies effective leadership strategies to support faculty technology integration. The findings bridge two key theoretical frameworks: the Technology Acceptance Model (TAM), which explains individual technology adoption decisions, and Path-Goal Theory, which illuminates the organizational leadership approaches that facilitate implementation of technology integration. From the TAM perspective, successful integration requires enhancing faculty perceptions of technology's usefulness through alignment with pedagogical and personal goals, while improving ease of use via infrastructure upgrades, collaborative environment and comprehensive training programs. Financial incentives and career advancement opportunities further reinforce perceived value, with mentorship programs effectively reducing perceived complexity through peer support. These individual-level factors are complemented by organizational leadership strategies informed by Path-Goal Theory: directive leadership clarifies institutional objectives, supportive leadership removes barriers through resource allocation, achievement-oriented leadership provides motivation through recognition systems, and participative leadership fosters collaboration proving particularly impactful in Wenzhou' s collectivist cultural context. While offering valuable insights, the study's single-city focus and time-bound data limit generalizability, as technology integration depends on broader contextual factors (Schweighofer et al., 2019; Tang et al., 2021). Future research should expand to diverse settings, employ longitudinal designs, and further examine how cultural-organizational variables interact with leadership approaches over time to strengthen both theoretical frameworks and practical implementation strategies for technology integration in higher education.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

YZ: Writing – original draft, Writing – review & editing. DC: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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