Scientific Research Publishing

Open Journal of Social Sciences, 2025, 13(11), 238-263
https://www.scirp.org/journal/jss
ISSN Online: 2327-5960
ISSN Print: 2327-5952

Exploring Digital Transformation in Educational Practices among Vocational College Administrators in Fujian, China

Hongxi Chen[1], Muhd Khaizer Omar[1,2]

[1]Faculty of Educational Studies, Universiti Putra Malaysia, Serdang, Selangor, Malaysia
[2]Centre for Postgraduate Studies, Kuala Lumpur University of Science and Technology, Kajang, Selangor, Malaysia
Email: khaizer@upm.edu.my

How to cite this paper: Chen, H. X., & Omar, M. K. (2025). Exploring Digital Transformation in Educational Practices among Vocational College Administrators in Fujian, China. *Open Journal of Social Sciences, 13,* 238-263.
https://doi.org/10.4236/jss.2025.1311014

Received: October 20, 2025
Accepted: November 11, 2025
Published: November 14, 2025

Abstract

This study investigates the challenges and struggles of digital transformation in higher vocational colleges in Fujian, China. Through semi-structured interviews with 17 mid- to senior-level administrators and qualitative coding using NVivo 14, four major themes emerged: (a) faculty adaptation and challenges, (b) enabling factors, (c) management practices, and (d) enhancement of teachers' digital skills and industry-education integration practices. The findings reveal that administrators encounter significant adaptation pressures, including disparities in digital literacy, resistance from senior faculty, and inconsistent data standards. Successful transformation is driven by leadership commitment, resource allocation, data-driven decision-making, and pilot initiatives that promote cross-departmental collaboration. Despite these advancements, challenges remain due to limited data governance and standardization capacities. This study provides actionable insights for policymakers, administrators, and technology developers seeking to facilitate sustainable digital transformation in vocational education.

Keywords

Digital Transformation, Vocational Education, Educational Management, Teacher Digital Adaptation

1. Introduction

The global advancement of digital technologies has significantly transformed education systems, prompting institutions to rethink their governance, pedagogy, and management (Urath, 2024; UNICEF, 2024). Governments worldwide are advocating for digital transformation to improve educational quality, efficiency, and equity (Wang et al., 2024). In China, a series of national policies have emphasized

modernizing educational governance through informatization, with higher vocational colleges identified as critical arenas for reform (Yang & Wu, 2024). As essential components of the vocational education system, these colleges play a vital role in cultivating skilled professionals and supporting regional economic transformation (Zhao & Selvaratnam, 2024).

Despite these advancements, many vocational institutions grapple with rigid administrative structures and varying levels of digital readiness. Although digital infrastructure has improved, challenges such as data fragmentation, low digital literacy, and ethical issues—particularly concerning privacy and algorithmic bias—continue to hinder progress (Yang, Guo, & Cui, 2023). Thus, digital transformation transcends mere technological upgrades; it demands managerial and organizational changes that require systemic coordination.

Global practices provide valuable insights into effective transformation strategies. Germany's "dual system" emphasizes collaboration between industry and education, while Singapore's integrated digital ecosystem nurtures lifelong learning (Lim et al., 2024). These examples illustrate that sustainable transformation relies on coherent strategies that connect policy, institutional governance, and industrial support. For China, adapting these models necessitates a sensitivity to local administrative traditions and resource limitations.

Fujian Province serves as a relevant case for this investigation. As an economically vibrant region at the forefront of educational reform, its higher vocational colleges have embarked on various digital management projects with mixed results. Understanding how administrators perceive and sustain these reforms can yield practical lessons for broader policy and institutional enhancements. Therefore, this study aims to explore how administrators in higher vocational colleges comprehend and manage the digital transformation process, focusing on the primary challenges they face, the factors that facilitate effective digital governance, and the strategies that promote institutional adaptation and sustainable reform.

2. Literature Review

Research focusing on administrators in higher education, particularly in the context of digital transformation, remains limited. Administrators play dual roles as end users and agents of organizational change, and their decisions regarding technology adoption are often influenced by institutional norms, organizational culture, and managerial responsibilities (Fedorov et al., 2022; Ben Kasmia & M'hamed, 2023). While previous studies have primarily examined the factors influencing technology adoption decisions, the pathways connecting technology use to management outcomes—such as administrative efficiency, decision-making quality, and resource utilization—have received less attention. Factors like organizational support, digital literacy, and professional development are critical in shaping these processes and warrant further investigation (Phakamach et al., 2023; UNICEF, 2024). Understanding these dynamics is vital for enhancing the effectiveness of digital governance in higher education.

In the realm of educational digitalization, the humanistic approach offers a value-oriented framework, positing that technology should enhance human well-being rather than merely improve management efficiency (Lopez et al., 2023). Recent studies indicate that digital governance within Chinese higher education frequently overlooks user needs and ethical considerations (Ben Kasmia & M'hamed, 2023). Consequently, administrators must prioritize users' emotional experiences and their willingness to participate, advocating co-creation and feedback mechanisms to humanize technological practices. This perspective indicates the importance of aligning technological advancements with the values and needs of users, ensuring that digital transformation serves broader educational goals beyond operational efficiency.

The interplay of management power and the configuration of institutional structures significantly influences the effectiveness of digital reform in higher vocational institutions. School-level managers exercise autonomy in areas like IT investment, resource allocation, and school-enterprise collaboration, which directly impacts the depth and efficiency of digital governance (Wrede et al., 2020). Insights from corporate management regarding strategic vision and decision-making ownership can also be applied to educational contexts. However, the predominant focus on instructional leadership in educational research often neglects the systemic competencies necessary for digital transformation, such as data governance and process reengineering (Hallinger et al., 2020). Distributed Leadership theory emphasizes collaborative change, yet in practice, school principals often retain central authority, leading to symbolic decentralization that may hinder teacher engagement and organizational innovation (Woods, 2016; Tian et al., 2016; Printy & Liu, 2020).

Furthermore, institutional structures and cultural traditions impose constraints on managerial power, particularly in highly centralized systems where decision-making flexibility is limited. This centralization affects technology deployment, data application, and interdepartmental collaboration (Bush & Ng, 2019). Although existing leadership theories provide foundational insights, they fall short of addressing the integrative authority required for effective digital reform. Administrators need competencies in technology strategy, data governance, and resource integration to navigate the complexities of digital transformation effectively (Daniëls et al., 2019; Bush, 2019). Given the unique challenges faced by Chinese vocational colleges, further empirical research is essential to understand how administrators can balance centralization with autonomy, ensuring that digital governance aligns with ethical considerations and promotes user engagement. To address these gaps, this study aims to: (a) explore the key challenges faced by vocational college administrators during digital transformation and (b) identify practical issues in technology implementation and propose optimization strategies.

3. Method

This study adopts a qualitative research design with an exploratory case study approach to gain an in-depth understanding of the experiences and management practices of vocational college administrators during the digital transformation pro-

cess. We examine how managers perceive and respond to management changes brought about by digitalization, as well as their practical responses within organizational settings. To enhance the systematic nature and transparency of the analysis, NVivo 12 Plus was used for coding and thematic analysis, drawing on its data management functions to categorize, summarize, and compare textual data.

This study focuses on digital transformation practices in higher vocational colleges in Fujian Province, China. Digitalization in education has introduced notable changes to administrative processes, teaching, and organizational management; however, systematic understanding of the associated management challenges and coping strategies remains limited. In this context, examining the practices of vocational college administrators helps identify key management issues and strategies that support effective digital governance. The participants of this study were middle-and senior-level managers, including vice presidents, division heads, and department heads, who were directly involved in digital governance, informatization projects, and academic management reforms. These individuals were selected for their relevant experience and understanding of institutional processes and management systems. Their perspectives are important for exploring how digital transformation is implemented and managed within organizational settings. The research was conducted in public higher vocational colleges in Fujian Province, where administrators encounter challenges such as technological adaptation, human resource management, and system integration. These institutions were examined as typical cases to provide a contextualized understanding of how management practices respond to digitalization. This approach facilitates the examination of both individual experiences and organizational dynamics.

Purposive sampling was employed to select participants who could provide relevant and representative information. The selection criteria included: 1) holding a formal management position in a public higher vocational institution; 2) being directly involved in or responsible for digital governance and academic management reform; 3) having at least three years of experience in education management and familiarity with institutional processes; and 4) providing informed consent for participation and use of data for academic purposes under anonymity. In total, 17 managers from various functional areas, including academic affairs, research, quality management, and information centers, participated in the study.

Before conducting formal interviews, two experts in higher education and digital management reviewed the interview protocol to ensure its academic soundness and practical relevance. The finalized semi-structured interview guide comprised 13 questions organized around five key areas: organizational processes and experiences related to digital reform, management roles and support systems, technical and human resource challenges, management ethics and risk perception, and suggestions for future digital transformation. Interviews were conducted through telephone, Tencent Meeting, and face-to-face sessions, each lasting approximately 30 - 45 minutes. Written informed consent was obtained from all participants. All interviews were recorded and transcribed verbatim, and participants were invited to

confirm the accuracy of selected transcripts to ensure data reliability.

A pilot interview was also conducted with two managers who met the sampling criteria but did not take part in the main study. The pilot aimed to examine the clarity and logical flow of the interview questions. Based on feedback, the researchers refined ambiguous wording, clarified overlapping items, and adjusted the interview duration to facilitate the smooth implementation of the main data collection process.

4. Results and Findings

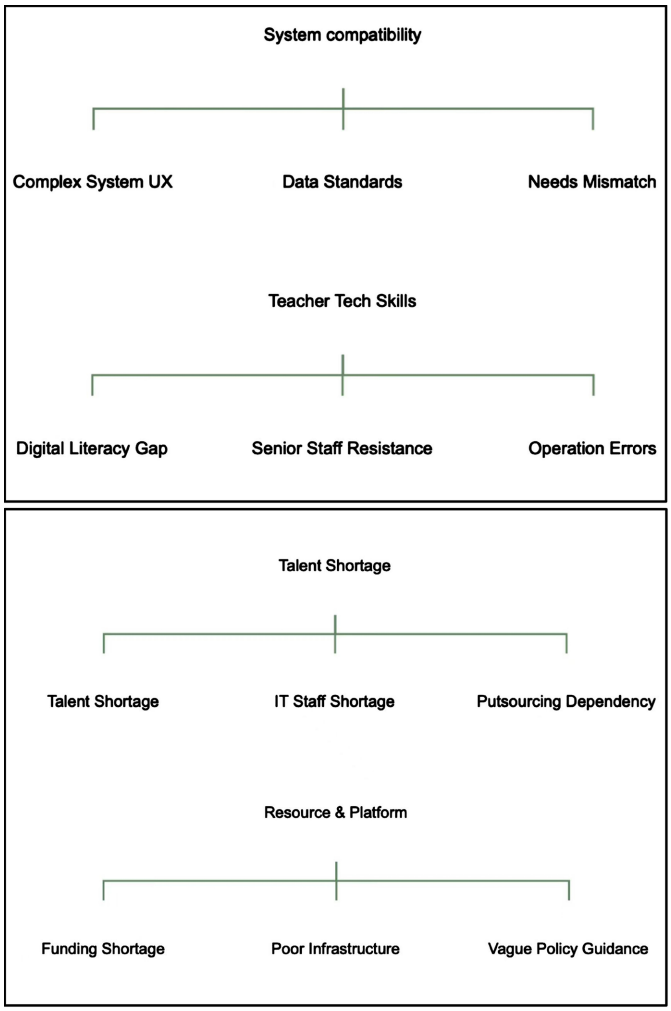
This study analysed 17 interview transcripts (approximately 105 pages) using NVivo 14 to identify challenges, supporting factors, and management practices in digital transformation of higher vocational colleges. Data were transcribed, coded, and organized into 17 primary themes and 49 subthemes, with 427 coding references. Frequency analysis indicated that funding shortages, interdepartmental efficiency, and sustained financial support were most frequently mentioned, followed by gaps in digital literacy, leadership support, and data-driven curriculum design. Short names were used for some subthemes (e.g., Teacher Tech Skills, System Compatibility) for clarity; a complete list is provided in Table 1.

Table 1. Themes and sub-themes.

Themes	Sub-themes
System Compatibility	System Compatibility and "Island Effect"
Teacher Tech Skills	Variations in Teachers' Technical Competence and Training
Talent Shortage	Shortage of Multidisciplinary Talents
Resource & Policy Limits	Resource and Policy Constraints
Leadership Support	Leadership Demonstration and Support
Resource & Platform	Resource Provision and Platform Optimization
Industry Alignment	School-Enterprise Collaboration and Industry Alignment
Teacher Training & Incentives	Teacher Training and Incentive Mechanisms
Student Outcomes	Student Adaptability and Outcomes
Admin Efficiency	Enhancement of Administrative Efficiency
Data-Driven Decisions	Data-Driven Decision Making
Communication Shift	Transformation of Communication Methods
Planning & Evaluation	Support for Planning and Evaluation
Teacher Digital Skills	Improvement of Teachers' Digital Skills
Industry–Education Integration	Integration of Industry and Education to Enhance Adaptability
Policy & Resource Support	Policy and Resource Support and Assurance
Evaluation & Feedback	Development of Evaluation and Feedback Mechanisms

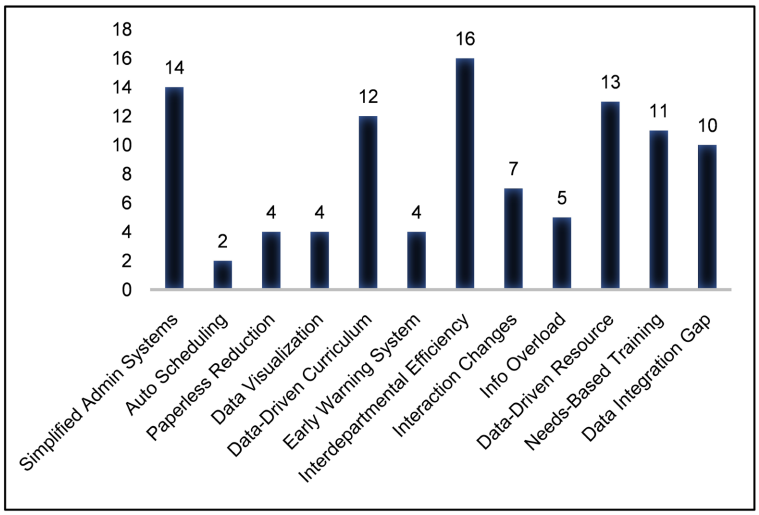
4.1. Teachers' Adaptation and Challenges in Digital Transformation

Under Theme 1, "Teachers' Adaptation and Challenges in Digital Transformation," comprised 17 sub-themes with 145 coding references, highlighting how faculty navigate digital reform in higher vocational colleges. High-frequency sub-themes included system compatibility, teacher technical skills, talent shortages, and resource or policy constraints, reflecting both technical and operational challenges shaped by institutional, human, and policy factors. Teachers demonstrated adaptive behaviors such as active learning, collaboration, and teaching innovation, while also reporting difficulties with uneven resource access, limited professional development, and increased workload. Lower-frequency sub-themes, such as equipment gaps and psychological pressure, point to specific institutional issues requiring attention in future reforms. Figures 1-3 summarize the coding structure, frequency distribution, and relative prominence of teachers' adaptation and challenges, indicating areas that influence the depth and sustainability of digital transformation.



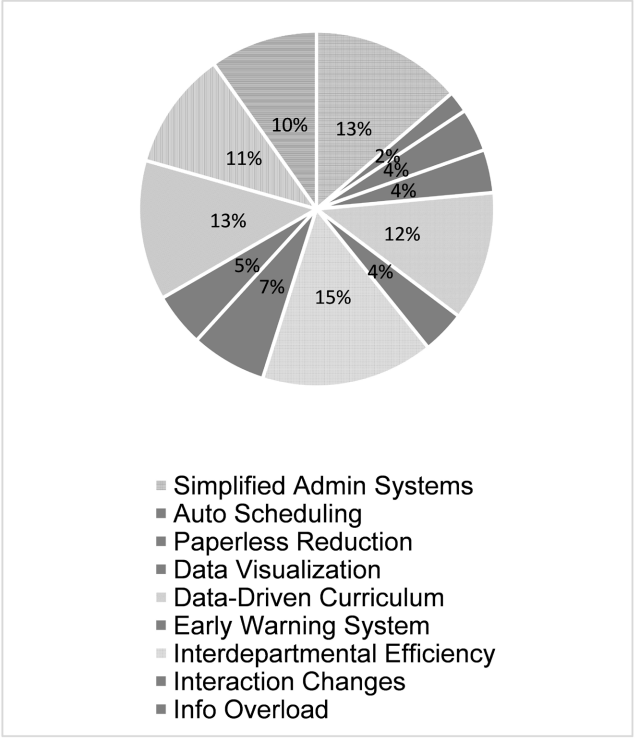
Note. System Compatibility; Teacher Training; Resource Support.

Figure 1. Hierarchical structure of subthemes under Theme 1.



Note. How digitalization improves management practice.

Figure 2. Frequency distribution of subthemes under Theme 1.



Note. How Digitalization Improves Management Practice.

Figure 3. Proportion of subthemes under Theme 1.

4.1.1. Funding Shortage

"Funding shortage" was the most frequently mentioned sub-theme, accounting for 19.3% of Theme 1 coding. Respondents highlighted that insufficient and non-sustained funding constrained digital transformation in vocational colleges. For example, one participant noted that many platforms operate for only a year or two before maintenance lags, degrading user experience (01/01/3). Another empha-

sized that costly software purchases, limited budgets, and annual funding cycles often hinder system development, leading to a "hot phase followed by a cold phase" (06/1/5; 12/1/5).

4.1.2. Digital Literacy Gap

"Digital Literacy Gap" appeared 14 times, accounting for 16% of Theme 1 coding. This theme reflects disparities in digital proficiency among faculty and staff. Younger teachers and administrators generally adapt quickly to new systems and actively explore innovative teaching methods, whereas some older faculty and staff remain accustomed to traditional paper-based or offline operations, experiencing difficulties with platform applications and occasional operational errors. For example, one interviewee noted: "Some older teachers and administrators have primarily worked with paper and handwriting in the past, or at most used WPS and Excel spreadsheets. Suddenly transitioning to online platforms presents challenges for them" (15/1/2). Another added: "Younger teachers quickly embrace new technologies… Some senior faculty members adopt the system more slowly and occasionally make operational errors" (02/1/3).

4.1.3. Senior Staff Resistance

"Senior Staff Resistance" appeared 10 times, accounting for 11.4% of Theme 1 coding. This theme reflects that some senior teachers exhibit resistance or a negative attitude during digital transformation, while younger teachers generally adapt quickly and provide improvement suggestions. One interviewee noted: "Some senior teachers have low acceptance of the new system and sometimes exhibit resistance" (01/1/2). Another added: "Some older teachers show resistance, are unclear about system operations, ask questions at every step, and sometimes accidentally delete entries requiring re-entry" (11/1/2).

4.1.4. Data Standards

"Data Standards" appeared 10 times, accounting for 11% of Theme 1 coding. This sub-theme reflects concerns about poor interoperability between systems and inconsistent data formats, which require manual integration and increase administrative workload. One respondent noted: "Information isn't fully integrated across different systems and platforms, requiring manual coordination for cross-departmental work" (04/1/2). Another added: "The main issue is the 'silo effect' between information systems. Different vendors supply the systems used by various university departments, and inconsistent data standards prevent data interoperability" (02/1/2).

4.1.5. Needs Mismatch

"Needs Mismatch" appeared 8 times, accounting for 9% of Theme 1 coding. This sub-theme reflects concerns about gaps between system design and practical teaching needs, leading to underutilization. One respondent stated: "The system failed to adequately account for the unique characteristics of our college's courses, resulting in severe scheduling chaos. We had to temporarily suspend its use… oth-

erwise, it not only fails to improve efficiency but also creates extra work" (01/1/4). Another noted: "Many systems are built with good intentions, but during actual implementation, issues arise such as mismatched scenarios and insufficient willingness among teachers to use them… updating teachers' mindsets and transforming teaching models takes time" (10/1/2).

4.1.6. Other Low-Frequency Subtopics

Other sub-themes in Theme 1 with lower frequency included complex system user experience (3 mentions), talent shortage (2 mentions), IT staff shortage (3 mentions), outsourcing dependency (3 mentions), poor infrastructure (4 mentions), and vague policy guidance (6 mentions). Although less frequent, these factors still constrain digital transformation. Respondents noted shortages of multidisciplinary talent, inadequate technical support, infrastructure misalignment, and limited funding affecting system updates and maintenance. Additionally, vague operational guidelines hinder implementation and evaluation, suggesting that clearer rules could support smoother transformation.

4.2. Key Support Factors for Digital Transformation

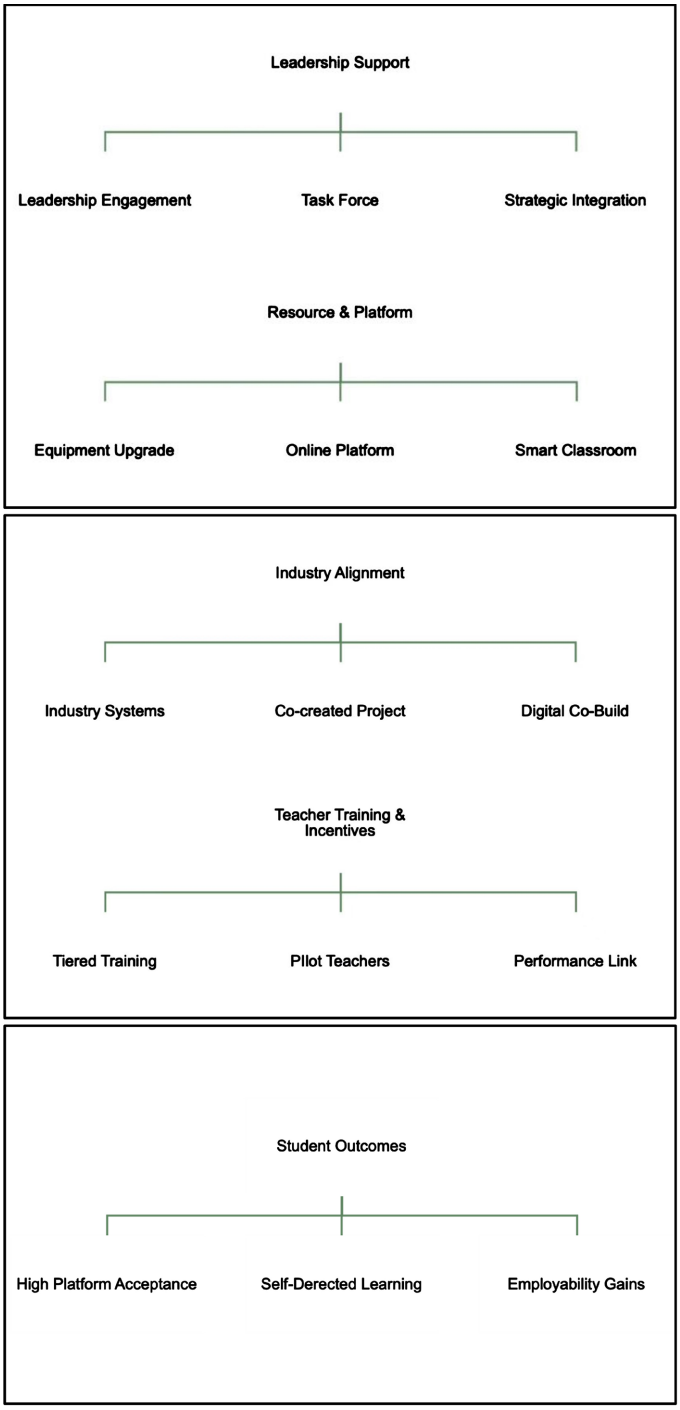
In Theme 2, "Key Support Factors for Digital Transformation," comprised 15 subthemes with 130 coding references, highlighting the human, material, and strategic factors that facilitate digital reform in higher vocational colleges. High-frequency sub-themes included Leadership Engagement (13 references, 10.0%), Equipment Upgrade (11 references, 8.5%), Online Platform Development (10 references, 7.7%), Tiered and Categorized Teacher Training (10 references, 7.7%), Pilot Teachers (13 references, 10.0%), High Platform Acceptance (14 references, 10.8%), and Improved Employability Outcomes (14 references, 10.8%). These findings indicate that effective digital transformation relies on leadership support, hardware and software infrastructure, teacher capacity building, and student learning strategies. Lower-frequency sub-themes, while less prominent, also contribute to systematic support for teaching and administrative digitalization. **Figure 4** illustrates the hierarchical structure and relative prominence of Theme 2, emphasizing the core elements necessary to ensure the smooth implementation of digital transformation.

4.2.1. Leadership Engagement

"Leadership Engagement" appeared 13 times, accounting for 10.0% of the coding within Theme 2. This sub-theme highlights the critical role of school leaders in guiding strategy, coordinating resources, and ensuring policy support during digital transformation. Strong leadership enhances execution capability and teacher confidence.

For example, one participant noted: "School leaders personally participate in system trials or research, coordinate resources in a timely manner, and address issues as soon as they arise. The leaders' attention directly affects execution and confidence" (01/2/1). Another added: "The school clearly promotes the use of

digital tools in teaching and administration, provides support through policies and funding, and encourages departments to try innovative approaches" (11/2/1). Participants also mentioned that flexible planning and a "use-and-adjust" approach help reduce teachers' concerns when adopting new systems (14/2/1).



Note. Leadership Support; Resource & Platform; Industry Alignment; Teacher Training & Incentives; Student Outcomes.

Figure 4. Hierarchical structure of key support factors under Theme 2.

4.2.2. Equipment Upgrade

"Equipment Upgrade" appeared 11 times, accounting for 8.5% of the coding within Theme 2. This sub-theme reflects colleges' investments in hardware and technological resources to support digital transformation, enhancing teaching efficiency and online instruction.

For instance, one participant noted: "The college upgraded the academic affairs system server to improve stability; smart blackboards and interactive projection equipment were installed; more portable terminals were provided for mobile office work and remote teaching. However, wireless signals in some classrooms remain unstable, affecting live teaching broadcasts" (02/2/3). Another added: "The school optimized the network environment in multimedia classrooms and introduced more comprehensive online platforms, improving convenience and efficiency. However, some platforms have short authorization periods, slow service responses, or lack mobile support, making it inconvenient to handle student affairs after class" (01/2/3).

4.2.3. Online Platform

"Online Platform" appeared 10 times, accounting for 7.7% of coding within Theme 2. This sub-theme reflects the role of comprehensive online platforms in supporting teaching, student learning, and digitalized management, enhancing teaching flexibility and interactivity.

For example, one participant noted: "The school has built a comprehensive online platform that supports teacher-student interaction, course management, and learning assessment, thereby enhancing teaching flexibility and quality" (11/2/3). Another added: "Some system modules do not fully align with vocational college needs, requiring manual data entry. New modules or secondary development require dedicated budget support to ensure the platform's long-term effectiveness" (17/2/3).

4.2.4. Tiered Training and Pilot Teachers

"Tiered Training" appeared 10 times and "Pilot Teachers" 13 times, accounting for 7.7% and 10.0% of coding within Theme 2. This sub-theme reflects the college's strategy to enhance system proficiency through tiered, role-specific training and demonstration by key instructors.

For instance, one participant noted: "Department- and position-specific group training proved significantly more effective than large-scale sessions. The Information Centre provided guidance during the system's initial launch, allowing teachers to seek immediate assistance, which boosted acceptance" (08/2/2). Another added: "Selecting proactive teachers as 'seed candidates' to master the system first before guiding others, combined with tutorials and screen recordings, markedly increased willingness to adopt the system" (17/2/2).

4.2.5. High Platform Acceptance and Self-Directed Learning

"High Platform Acceptance" appeared 14 times and "Self-Directed Learning" 4 times, accounting for 10.8% and 3.1% of coding within Theme 2. This sub-theme

reflects students' acceptance of digital platforms and their ability to engage in self-directed learning.

For example, one participant noted: "Students in applied majors show high acceptance of tools like online experiment platforms, virtual simulations, and smart classrooms" (13/2/5). Another added: "Students find the internship and training management system convenient for checking placements, submitting records, and clocking in" (14/2/5). Regarding self-directed learning, one participant stated: "Students are proficient in using online discussions and group collaboration. They are more proactive in class and integrate theory with practice through the platform, enhancing learning outcomes" (11/2/5).

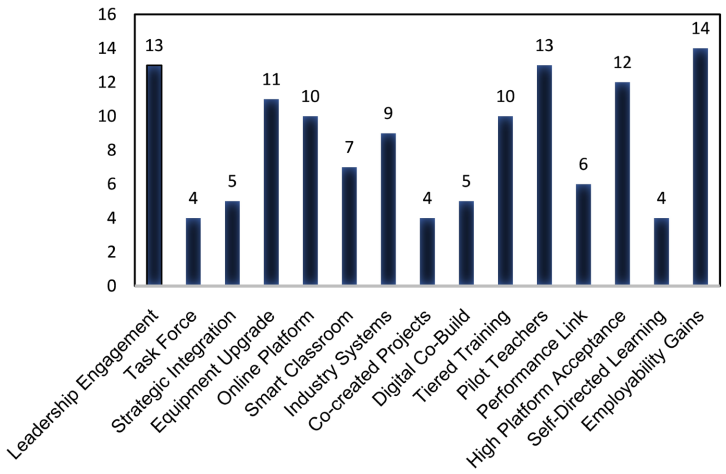
4.2.6. Employability Gains

"Employability Gains" appeared 14 times, accounting for 10.8% of coding within Theme 2. This sub-theme reflects the positive impact of digital transformation on students' employability.

For instance, one participant noted: "Students interning at subway and rail transit companies, having undergone simulated training exercises, adapt quickly to on-the-job training" (10/2/5). Another added: "Students reported that the systems were similar to what they learned in school, making adaptation stress-free. Digital tools support teaching and serve as a bridge to the workplace" (15/2/5).

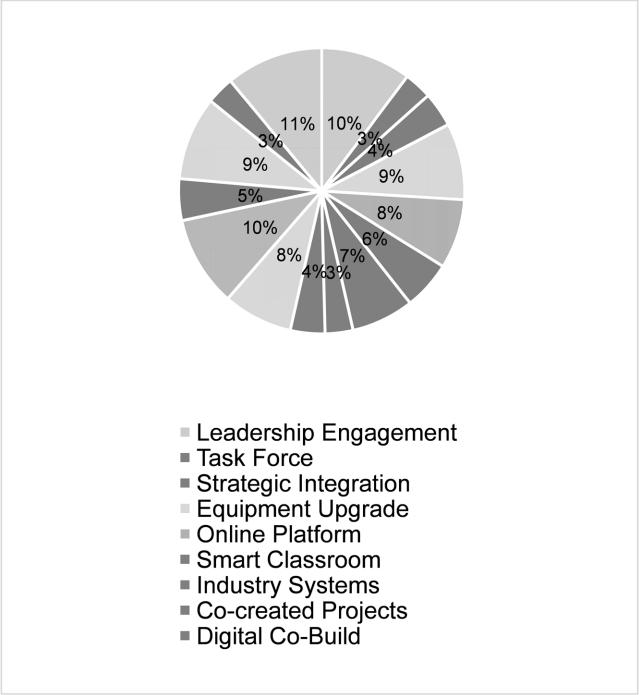
Other low-frequency sub-themes include Task Force (4), Strategic Integration (5), Smart Classroom (7), Industry Systems (9), Co-created Projects (4), Digital Co-Build (5), and Performance Link (6). These sub-themes, though less frequent, support digital transformation by enhancing cross-department collaboration, technical teaching support, participation and innovation in curriculum design, and linking digital applications to teaching and management performance.

Figure 5 and Figure 6 illustrate the frequency and relative proportion of all sub-themes within Theme 2.



Note. Key Supporting Factors for Success.

Figure 5. Frequency distribution of subthemes under Theme 2.



Note. Key Supporting Factors for Success.

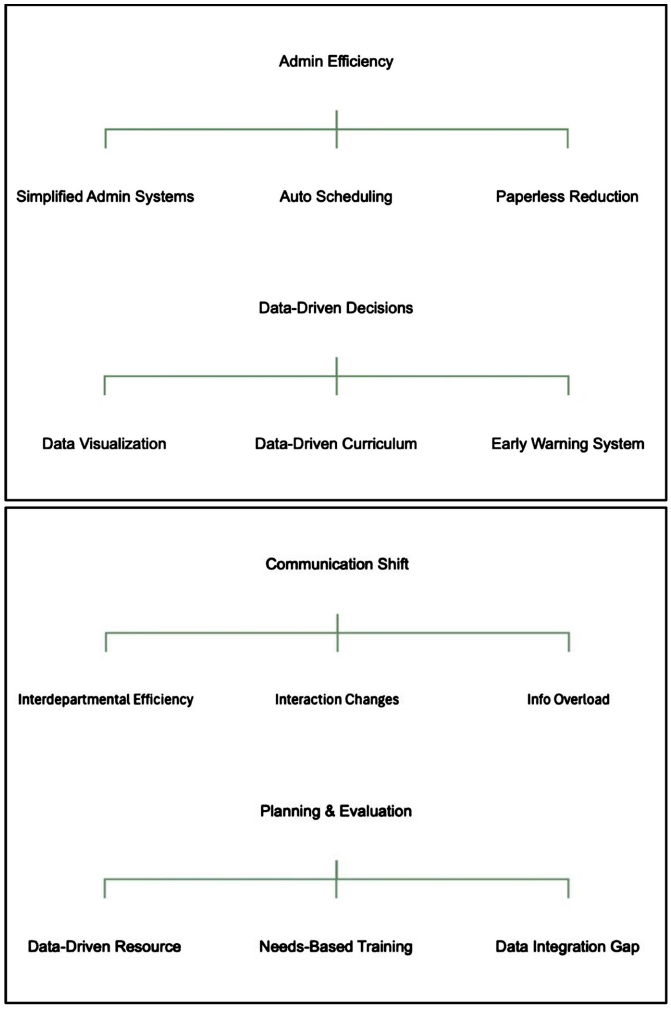
Figure 6. Proportion of subthemes under Theme 2.

4.3. Management Practices in Digital Transformation

In Theme 3, "Management Practices in Digital Transformation" comprised 12 sub-themes with 108 coding occurrences, highlighting how vocational colleges implement digital management strategies. High-frequency sub-themes included Interdepartmental Efficiency (16 occurrences, 14.8%), Simplified Admin Systems (14 occurrences, 13%), Data-Driven Resource Allocation (13 occurrences, 12%), Data-Driven Curriculum (12 occurrences, 11.1%), Needs-Based Training (10 occurrences, 9.3%), and Data Integration Gap (10 occurrences, 9.3%). These sub-themes reflect core practices such as optimizing administrative workflows, improving cross-department collaboration, allocating resources scientifically, refining curriculum design, and designing targeted teacher training programs. Lower-frequency sub-themes—Auto Scheduling (2), Paperless Reduction (4), Data Visualization (4), Early Warning System (4), Interaction Changes (7), and Info Overload (5)—indicate supplementary practices that enhance operational efficiency, information transparency, and proactive management. **Figure 7** summarizes the coding structure, frequency distribution, and relative prominence of management practices, highlighting key factors for evidence-based decision-making and efficiency improvement.

4.3.1. Interdepartmental Efficiency

"Interdepartmental Efficiency" appeared 16 times, accounting for 14.8% of Theme 3 coding. This sub-theme reflects how vocational colleges enhance cross-departmental collaboration using instant messaging, collaborative office platforms, and



Note. Admin Efficiency; Data-Driven Decisions; Communication Shift; Planning and Evaluation.

Figure 7. Hierarchical structure of subthemes under Theme 3.

online document systems. Respondents indicated that these digital tools reduce manual and paper-based workflows while improving transparency and execution efficiency. For example, one participant noted: "Through tools like WeChat, DingTalk, and online documents, we can communicate in real time, boosting work efficiency. Previously, much information was conveyed via phone calls or manual document delivery" (11/3/3). Another added: "Notifications, material exchanges, and task assignments between teachers, counsellors, and departments are mostly handled online; internship schedules for all grades were filled in a single document, allowing real-time editing and convenient viewing" (06/3/3). A third respondent emphasized: "For matters like class rescheduling, classroom borrowing, and urgent notifications, digital platforms offer timely and traceable feedback, replacing printed documents and physical workflows" (12/3/3). However, some participants also mentioned issues related to "information overload", noting that multiple platforms and repetitive notifications caused confusion and message omissions. As one teacher

explained: "Sometimes one notice must be sent to several groups, and repeated reminders make the information messy" (13/3/3). Another added: "We need to switch between too many platforms, and some require installing separate apps on mobile phones. This system fragmentation is also a problem" (15/3/3).

4.3.2. Simplified Admin Systems

"Simplified Admin Systems" appeared 14 times, accounting for 13% of Theme 3 coding. This sub-theme reflects how digital systems streamline administrative processes, enhancing efficiency in approvals, document management, and course scheduling. Respondents noted that digital tools reduce manual labor, eliminate paper-based procedures, and improve data transparency. For example, one participant stated: "We now use OA office systems, HR platforms, and the Smart Campus data centre. Tasks like leave approvals or certificate printing previously required offline signatures and multiple trips; now they can be completed with a single click, with real-time progress and instant report export" (03/13/1). Another added: "The academic affairs system handles student records, course scheduling, and grade entry on a single platform, reducing processing time from several days to one and lowering error rates" (02/3/1). A third respondent emphasized: "Faculty can submit annual summaries and professional title applications online, with automatic archiving; the system generates performance reports, reducing redundant work and enhancing transparency and fairness" (03/3/1).

4.3.3. Data-Driven Resource

"Data-Driven Resource" appeared 13 times, accounting for approximately 12.0% of the total codes under Theme Three. This sub-theme reflects how vocational colleges achieve scientific and refined resource allocation during digital transformation by collecting and analysing data on teaching, experiments, equipment, and finances. Respondents generally agreed that data-driven resource management not only enhances decision-making accuracy but also optimizes the efficiency of fund and equipment utilization.

For instance, one respondent noted: "The most significant change brought by digitalization is resource allocation. Annual budget planning now integrates data on classroom and lab usage frequency, equipment maintenance records, and course offerings. This makes it immediately clear where capacity needs expansion and where optimization is possible." (10/3/4)

Another respondent added: "Training records were previously scattered. Now the system automatically logs training frequency, content, and hours, providing stronger justification for faculty development budgets. The financial system allows viewing historical expenditure structures, providing reference for future digital project funding adjustments." (13/3/4)

Additionally, another respondent noted: "By analysing student engagement and resource usage through the platform, we can adjust teaching content and resources to maximize utilization. This also enables more rational planning for equipment upgrades and network infrastructure development." (11/3/4)

4.3.4. Data-Driven Curriculum

"Data-Driven Resource" appeared 13 times, accounting for 12% of Theme 3 coding. This sub-theme reflects how vocational colleges optimize resource allocation through data on teaching, experiments, equipment, and finances, enhancing decision-making accuracy and resource efficiency. For example, one participant noted: "Annual budget planning now integrates data on classroom and lab usage, equipment maintenance, and course offerings, clarifying where capacity needs expansion or optimization" (10/3/4). Another added: "Training records were previously scattered; now the system logs frequency, content, and hours, supporting faculty development budgets. Historical expenditure data informs future digital project funding" (13/3/4). A third respondent emphasized: "Analyzing student engagement and resource usage enables adjustment of teaching content and resources, and guides equipment upgrades and network development" (11/3/4).

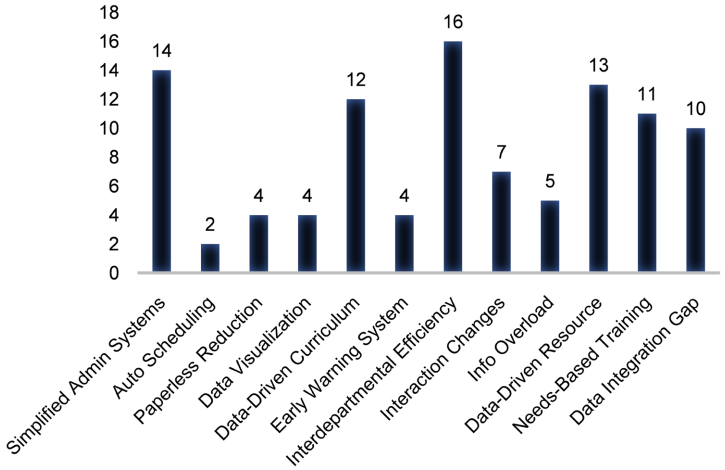
4.3.5. Needs-Based Training

"Needs-Based Training" appeared 10 times, accounting for 9.3% of Theme 3 coding. This sub-theme reflects how vocational colleges design targeted, data-driven teacher training to enhance digital competencies and teaching efficiency. One participant noted: "Annual faculty training plans schedule digital literacy courses based on system usage feedback to help faculty adapt to platform operations and acquire analytical skills" (01/3/4). Another added: "Training prioritizes roles with weaker operational capabilities, considering system usage frequency and feedback" (04/3/4). Additionally, tracking data such as course offerings, teaching hours, classroom utilization, and funding structures informs adjustments to future training content and formats (12/3/4).

4.3.6. Data Integration Gap

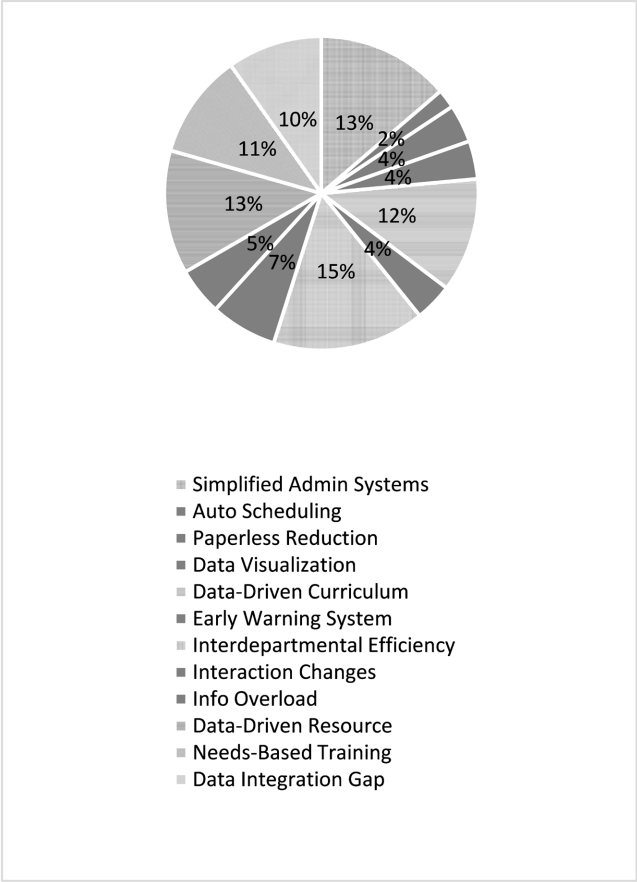
"Data Integration Gap" appeared 10 times, accounting for 9.3% of Theme 3 coding. This sub-theme reflects insufficient integration across departmental systems, requiring manual cross-platform data processing and leading to duplicate entries and errors. One participant noted: "Although each department has its own system, data doesn't connect well. Sometimes we have to export and integrate it ourselves, which is prone to errors" (13/3/5). Another added: "Systems keep multiplying, yet merging data from multiple platforms still requires manual processing" (16/3/4). Others emphasized: "The academic affairs system, OA system, and student evaluation platform operate independently without synchronization, causing duplicate data entry" (08/3/5).

Other low-frequency sub-themes include Auto Scheduling (2 mentions), Paperless Reduction (4), Data Visualization (4), Early Warning System (4), Interaction Changes (7), and Info Overload (5). These sub-themes support digital transformation by improving scheduling efficiency, enhancing information transparency, enabling early alerts, optimizing communication, and promoting better data management practices. Figure 8 and Figure 9 illustrate sub-theme frequencies and relative proportions.



Note. How Digitalization Improves Management Practice.

Figure 8. Frequency distribution of subthemes under Theme 3.



Note. How Digitalization Improves Management Practice.

Figure 9. Proportion of subthemes under Theme 3.

At the same time, the issue of "Info Overload" reflects another consequence of insufficient data integration. Respondents mentioned that fragmented systems

and repeated notifications across multiple platforms increased their cognitive burden. As one teacher explained: "There are too many systems to check, and messages often repeat or get lost among different groups" (15/3/3). Another respondent noted: "Information keeps coming from various apps, and we spend a lot of time confirming what has already been sent" (13/3/3).

4.4. Enhancement of Teachers' Digital Skills and Industry-Education Integration Practices

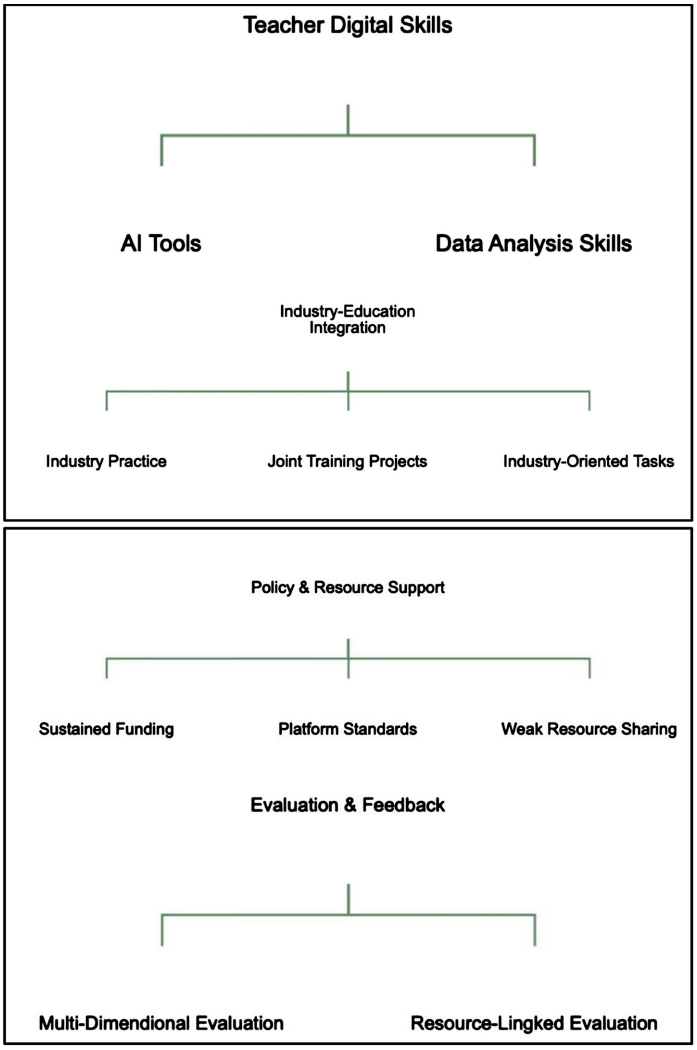
In Theme 4, "Enhancement of Teachers' Digital Skills and Industry–Education Integration Practices" comprised 11 sub-themes with 99 coding occurrences, highlighting how vocational colleges promote teacher digital competence and industry engagement during digital transformation. High-frequency sub-themes included Multi-Dimensional Evaluation (17 occurrences, 17.2%), Sustained Funding (16 occurrences, 16.2%), Data Analysis Skills (13 occurrences, 12.1%), AI Tools (12 occurrences, 13.0%), and Industry Practice (13 occurrences, 12.1%). These sub-themes reflect a combination of scientific evaluation, financial support, technology application, data skills development, and industry engagement to support teacher development and curriculum optimization. Respondents generally emphasized that multi-dimensional evaluation provides a scientific basis for monitoring platform effectiveness and teaching–learning outcomes; sustained funding and AI tools ensure smooth implementation of training and digital initiatives; enhancement of data analysis skills enables precise instructional design; and industry practice strengthens understanding of current industry standards and the practical value of teaching cases. **Figure 10** illustrates the coding frequency distribution for these sub-themes.

4.4.1. Multi-Dimensional Evaluation

"Multi-Dimensional Evaluation" appeared 17 times, accounting for approximately 17.2% of the coding within Theme 4, reflecting the importance of establishing a scientific and comprehensive evaluation system during digital transformation. Respondents emphasized assessing not only teaching outcomes but also platform effectiveness, faculty workload, and student learning improvements. For example, one noted: "We should establish a multi-dimensional evaluation system that integrates teaching quality assessments, student satisfaction surveys, and platform backend usage data." (01/4/4) Another added: "Evaluations should cover user satisfaction, changes in teaching and management efficiency, and student learning outcomes, forming comprehensive reports to guide improvements." (11/4/4) Overall, such evaluation mechanisms provide a scientific basis for monitoring platform performance and optimizing teaching practices.

4.4.2. Sustained Funding

"Sustained Funding" appeared 16 times, accounting for approximately 16.2% of the coding within Theme 4, highlighting the importance of continuous financial



Note. Teacher Digital Skills; Industry-Education Integration; Policy and Resource Support; Evaluation & Feedback.

Figure 10. Hierarchical structure of subthemes under Theme 4.

support for digital transformation and related training. Respondents noted that dedicated funding ensures smooth implementation of teacher training, platform development, AI tools, and industry practice programs. For example, one stated: "Establishing dedicated training funds for digital transformation would significantly improve implementation. Most current budgets are general-purpose and cannot cover AI tools or platform operations." (10/4/3) Another added: "Dedicated funding for targeted training or hiring professional instructors greatly benefits both teachers and administrators." (4/15/3) Sustained financial support thus underpins effective digital initiatives and teacher development.

4.4.3. AI Tools

"AI Tools" appeared 12 times, accounting for approximately 13.0% of the coding within Theme 4, highlighting the role of AI-assisted teaching and management tools in enhancing teachers' digital skills and instructional design. Respondents

noted that AI tools support lesson preparation, data-driven instructional decisions, and teaching effectiveness, though challenges include limited faculty experience and lack of systematic guidance. For example, one stated: "Many teachers are willing to try digital platforms but don't know how to effectively leverage data for teaching improvement." (01/4/1) Another added: "While basic platform operations are mastered, gaps remain in using AI for lesson preparation and instructional design; younger teachers are interested but often have to 'feel their way forward'." (14/4/1)

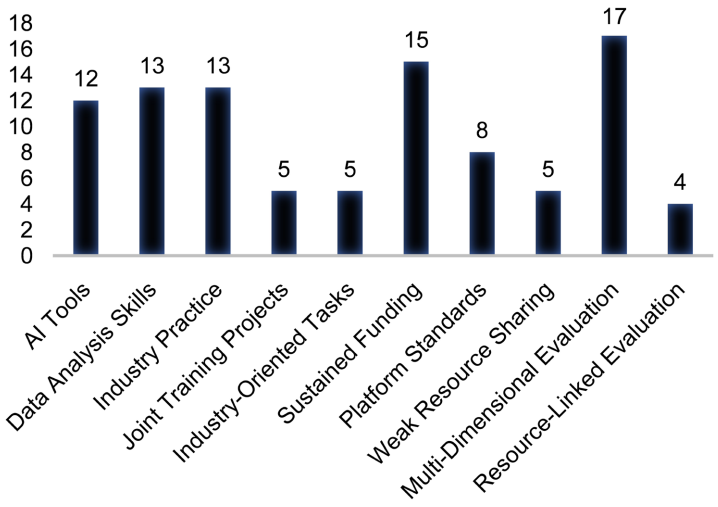
4.4.4. Data Analysis Skills

"Data Analysis Skills" appeared 13 times, accounting for approximately 12.1% of the coding within Theme 4, highlighting the need to strengthen faculty capabilities in leveraging instructional data for teaching and management. Respondents noted that enhancing data analysis skills is crucial for refining course design, monitoring student progress, and using AI-assisted tools. For example, one stated: "Many teachers are willing to try digital platforms but don't know how to effectively apply data to teaching improvements." (01/4/1) Another added: "While platforms offer features like intelligent question banks and learning trajectory analysis, few teachers know how to use them or interpret the data meaningfully." (11/4/1)

4.4.5. Industry Practice

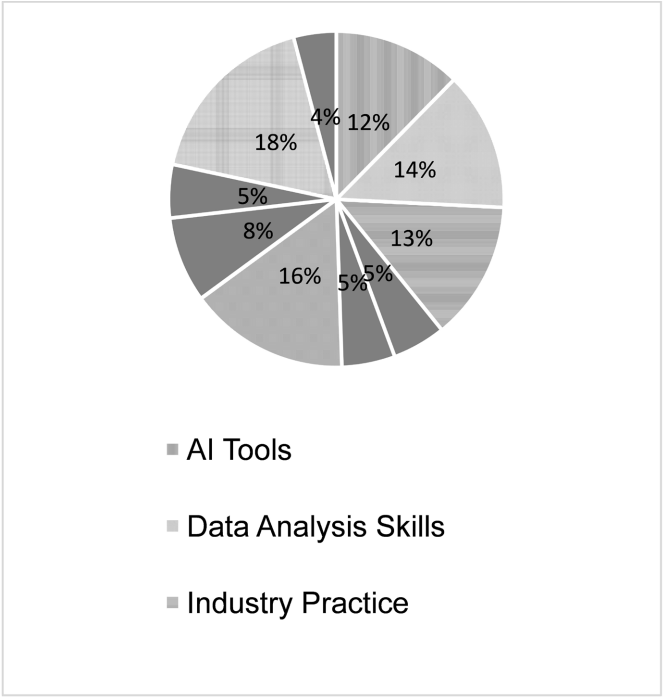
"Industry Practice" appeared 13 times, accounting for approximately 12.1% of the coding within Theme 4, highlighting the role of faculty participation in corporate internships and industry–education integration to enhance teaching relevance and professional skills. Respondents noted that such practices help teachers integrate current industry insights into courses, improving students' practical understanding and engagement. For example, one stated: "After participating in rail transit company projects, teachers can integrate the latest industry insights into their teaching, making courses feel more 'grounded' to students." (10/4/2) Another added: "Through hands-on training and sharing experiences from cross-border e-commerce programs, courses become more practical, sparking greater student interest." (11/4/2)

Low-frequency sub-themes, including Joint Training Projects, Industry-Oriented Tasks, Platform Standards, Weak Resource Sharing, and Resource-Linked Evaluation, also play supporting roles. Respondents emphasized that joint projects and industry tasks provide teachers with direct exposure to professional workflows, while challenges remain in platform standards and resource sharing. Resource-linked evaluation, through self-assessments and case studies, helps monitor platform effectiveness and guide improvements. High-frequency sub-themes dominate the coding, with low-frequency sub-themes supplementing implementation. Figure 11 and Figure 12 illustrate the sub-theme proportions and overall framework for faculty digital skill enhancement and industry–education integration practices.



Note. Optimizing Adaptation to Technology and Digitalization.

Figure 11. Frequency distribution of subthemes under Theme 4.



Note. Optimizing Adaptation to Technology and Digitalization.

Figure 12. Proportion of subthemes under Theme 4.

5. Discussion

This study identifies a complex interplay of challenges, supporting factors, and management practices shaping digital transformation in higher vocational colleges. The findings reveal that faculty face a convergence of five primary challenges: insufficient funding, digital literacy gaps, resistance from senior faculty, poor system compatibility, and misaligned technological needs. These factors collectively con-

strain faculty adaptability, which emerges as the critical linchpin determining the success of digital initiatives. This indicates that digital transformation is not merely a technological upgrade but a systemic process dependent on the coordinated interplay of human competence, institutional support, and technological integration.

The alignment of these challenges with existing literature confirms their universality. Prior research has consistently highlighted inadequate infrastructure, funding limitations, and disparities in digital literacy as common barriers in higher education (Carmo et al., 2025; Martin & Xie, 2022). However, this study extends this understanding by uncovering deeper structural issues. For instance, resistance from experienced faculty often stems not from intrinsic attitudes but from systemic failures—inadequate training, a lack of incentives, or technology designs that ignore practical classroom needs. This critical distinction suggests that administrators must look beyond superficial resistance to address the underlying institutional and design flaws that fuel it. This pattern is consistent with the findings in Theme 1. Senior faculty resistance often occurs alongside the "Digital Literacy Gap" and "Needs Mismatch". Many experienced teachers received limited training and found that system functions did not match their actual teaching needs. These conditions reduced their willingness to engage with new technologies. Therefore, their resistance is more likely caused by systemic and design-related constraints rather than personal attitudes.

These teacher-level challenges affect the implementation of teaching activities and bring new managerial and decision-making challenges to administrators. First, teachers' limited digital literacy and the unequal distribution of training resources create coordination pressure when designing training programs and allocating budgets. Second, the resistance of some senior teachers slows the integration of new technologies into teaching, increasing administrators' workload in communication and motivation. Moreover, the gap between technological requirements and instructional goals adds uncertainty to decision-making, forcing management to balance technological investment with practical feasibility.

Conversely, the study also identifies key enabling factors that facilitate transformation. Leadership support, strategic equipment upgrades, and the development of robust online platforms were widely recognized as foundational. Furthermore, tiered training programs, the influence of exemplary early adopters, high student acceptance, and tangible employment benefits for graduates were pivotal in motivating faculty engagement. These findings resonate with organizational change theory, emphasizing that successful transformation requires multi-dimensional support systems that simultaneously address motivation, capability, and opportunity (Carmo et al., 2025). The positive student outcomes, such as enhanced engagement and employability, align with global observations on the benefits of digital vocational education (Sappaile, 2025), though their attribution requires cautious interpretation amid external market forces.

These enabling factors collectively mitigate the barriers identified in Theme 1.

Tiered training and peer mentoring programs contribute to narrowing the digital literacy gap and alleviating senior faculty resistance by offering structured, needs-oriented learning opportunities. Leadership commitment remains essential for sustaining motivation and fostering a supportive institutional climate. When teachers observe tangible benefits for students, they tend to adopt digital practices more willingly and progressively. Furthermore, these supports establish a feedback mechanism that links individual adaptation with institutional management. Well-designed training frameworks and transparent communication channels help reduce coordination pressures and enhance the overall efficiency of policy implementation.

At the management level, digital transformation manifests in three key practices: enhanced cross-departmental collaboration, data-driven decision-making for resource allocation and curriculum design, and streamlined administrative processes. While digital tools can significantly improve communication and transparency, their efficacy is not automatic. As Antonopoulou et al. (2023) note, realizing these gains depends on parallel improvements in governance, clear responsibility delineation, and sustained leadership. Similarly, the potential of data-driven optimization is often hampered by poor data integration and inconsistent standards (Li et al., 2024), pointing to the necessity of strong data governance frameworks (Vincent-Lancrin & González-Sancho, 2023).

A significant managerial challenge that emerged is information overload. The proliferation of systems and data can paradoxically impede decision-making and increase cognitive burden, suggesting that institutions must prioritize information governance, interface simplification, and intelligent filtering to prevent "data fatigue" (Tafesse et al., 2024). Finally, an alternative explanation for perceived efficiency gains warrants consideration: some improvements may be attributable to behavioral inertia from pandemic-era remote work habits rather than the new digital systems themselves. This highlights the need for longitudinal research to disentangle the specific impacts of technological investment from other concurrent factors.

From a practical perspective, sustainable transformation requires long-term financial planning, systematic, needs-aligned teacher development, and effective data governance. Tiered training, peer-led "seed teacher" programs, and feedback mechanisms can enhance faculty engagement and system usability, while improved interoperability mitigates data silos and overload. Transparent communication of the impact on student outcomes can further sustain institutional support.

6. Conclusion

This study demonstrates that digital transformation in higher vocational colleges is a complex, systemic endeavor, where success is determined not by technology alone, but by the synergistic alignment of institutional, human, and technological factors. The findings reveal that the process is inherently non-linear, as advancements in one area—such as system upgrades—are often undermined by constraints

in others, like faculty readiness or unsustainable funding. Crucially, the research highlights that user adoption is not merely a training issue but a design one; the alignment between digital tools and actual teaching needs directly dictates faculty willingness to engage. Furthermore, the pursuit of external legitimacy emerges as a vital, yet often overlooked, institutional motivator for sustaining these efforts. Finally, the study establishes that the post-adoption phase presents its own critical challenges, where a lack of data maturity and poor system integration can cripple potential gains, demanding parallel investments in organizational learning and process re-engineering. In essence, this article concludes that for digital transformation to be effective and sustainable, it must be managed as an integrated organizational change. This requires continuous coordination between technological investment, supportive institutional structures, and a deep-seated commitment to developing human capital.

Acknowledgements

The authors would like to express their sincere gratitude to the Faculty of Educational Studies, Universiti Putra Malaysia for funding the publication fee of this article.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

Antonopoulou, K., Begkos, C., & Zhu, Z. (2023). Staying Afloat amidst Extreme Uncertainty: A Case Study of Digital Transformation in Higher Education. *Technological Forecasting and Social Change, 192,* Article ID: 122603. https://doi.org/10.1016/j.techfore.2023.122603

Ben Kasmia, N., & M'hamed, H. (2023). Digitalization of Higher Education: Impacts on Management Practices and Institutional Development. A Literature Review. *Conhecimento & Diversidade, 15,* 56-82. https://doi.org/10.18316/rcd.v15i39.11135

Bush, T. (2019). *Leadership and Management in Education*. Routledge.

Bush, T., & Ng, A. Y. M. (2019). Distributed Leadership and the Malaysia Education Blueprint. *Journal of Educational Administration, 57,* 279-295. https://doi.org/10.1108/jea-11-2018-0206

Carmo, J. E. S., Lacerda, D. P., Klingenberg, C. O., & Piran, F. A. S. (2025). Digital Transformation in the Management of Higher Education Institutions. *Sustainable Futures, 9,* Article ID: 100692. https://doi.org/10.1016/j.sftr.2025.100692

Daniëls, E., Hondeghem, A., & Dochy, F. (2019). A Review on Leadership and Leadership Development in Educational Settings. *Educational Research Review, 27,* 110-125. https://doi.org/10.1016/j.edurev.2019.02.003

Fedorov, A. A., Budarina, A. O., Polupan, K. L., & Zhitinevich, D. G. (2022). Digital Reform of Higher Education: Implementation Experience. *Samara Journal of Science, 11,* 325-331. https://doi.org/10.55355/snv2022112311

Hallinger, P., Gümüş, S., & Bellibaş, M. Ş. (2020). "Are Principals Instructional Leaders Yet?" A Science Map of the Knowledge Base on Instructional Leadership, 1940-2018.

Scientometrics, 122, 1629-1650. https://doi.org/10.1007/s11192-020-03360-5

Li, H., Gu, H., Hao, X., Yan, X., & Zhu, Q. (2024). Data-Driven Analytics for Student Reviews in China's Higher Vocational Education MOOCs: A Quality Improvement Perspective. *PLOS ONE, 19,* e0298675. https://doi.org/10.1371/journal.pone.0298675

Lim, Z. Y., Yap, J. H., Lai, J. W., Mokhtar, I. A., Yeo, D. J., & Cheong, K. H. (2024). Advancing Lifelong Learning in the Digital Age: A Narrative Review of Singapore's Skillsfuture Programme. *Social Sciences, 13,* Article No. 73. https://doi.org/10.3390/socsci13020073

Lopez, I., Hammersley, J., & Nerantzi, C. (2023). Uncovering People Centred Design in the Context of Curriculum and Learning Design in Higher Education. *International Journal of Management and Applied Research, 10,* 81-92. https://doi.org/10.18646/2056.102.23-007

Martin, F., & Xie, K. (2022). Digital Transformation in Higher Education: 7 Areas for Enhancing Digital Learning. *EDUCAUSE Review (Online).*

Phakamach, P., Panjarattanakorn, D., Saengkaew, P., Pangthai, S., & Onsampant, S. (2023). Innovative Practices in Vocational Education Administration. *International Journal of Educational Communications and Technology, 3,* 1-19. https://ph01.tci-thaijo.org/index.php/IJECT/article/view/250991

Printy, S., & Liu, Y. (2020). Distributed Leadership Globally: The Interactive Nature of Principal and Teacher Leadership in 32 Countries. *Educational Administration Quarterly, 57,* 290-325. https://doi.org/10.1177/0013161x20926548

Sappaile, B. I. (2025). The Impact of Digital Literacy Programs on Students' Critical Abilities in Vocational High Schools (SMK). *Indonesian Journal of Education, 5,* 563-577. https://www.injoe.org/index.php/INJOE/article/view/252

Tafesse, W., Aguilar, M. P., Sayed, S., & Tariq, U. (2024). Digital Overload, Coping Mechanisms, and Student Engagement: An Empirical Investigation Based on the S-O-R Framework. *Sage Open, vol. 14.* https://doi.org/10.1177/21582440241236087

Tian, M., Risku, M., & Collin, K. (2016). A Meta-Analysis of Distributed Leadership from 2002 to 2013. *Educational Management Administration & Leadership, 44,* 146-164. https://doi.org/10.1177/1741143214558576

UNICEF East Asia and Pacific Regional Office (2024). *Teachers' Digital Literacy in the East Asia and Pacific Region*. UNICEF. https://www.unicef.org/eap/reports/teachers-digital-literacy-east-asia-and-pacific-region

Urath, S. (2024). Stepping into the Digital Era: Transformation of School Administration Efficiency and Educational Management through the Role of Information Technology. *Indo-MathEdu Intellectuals Journal, 5,* 2009-2020.

Vincent-Lancrin, S., & González-Sancho, C. (2023). *Interoperability: Unifying and Maximising Data Reuse within Digital Education Ecosystems*. OECD Publishing.

Wang, C., Chen, X., Yu, T., Liu, Y., & Jing, Y. (2024). Education Reform and Change Driven by Digital Technology: A Bibliometric Study from a Global Perspective. *Humanities and Social Sciences Communications, 11,* Article No. 256. https://doi.org/10.1057/s41599-024-02717-y

Woods, P. A. (2016). Authority, Power and Distributed Leadership. *Management in Education, 30,* 155-160. https://doi.org/10.1177/0892020616665779

Wrede, M., Velamuri, V. K., & Dauth, T. (2020). Top Managers in the Digital Age: Exploring the Role and Practices of Top Managers in Firms' Digital Transformation. *Managerial and Decision Economics, 41,* 1549-1567. https://doi.org/10.1002/mde.3202

Yang, C., Guo, R., & Cui, Y. (2023). What Affects Vocational Teachers' Acceptance and Use of ICT in Teaching? A Large-Scale Survey of Higher Vocational College Teachers in China. *Behavioral Sciences, 13,* Article No. 77. https://doi.org/10.3390/bs13010077

Yang, X., & Wu, W. (2024). Advancing Digital Transformation in TVET through International Cooperation: Approaches by the UNESCO Chair on Digitalization in TVET. *Vocation, Technology & Education, 1,* 1-14. https://doi.org/10.54844/vte.2024.0585

Zhao, D., & Selvaratnam, D. P. (2024). A Systematic Literature Review on the Reform of Vocational Education in China. *Cogent Education*, *11*, 1-16. https://doi.org/10.1080/2331186X.2024.2343525