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Artificial intelligence adoption and teachers' technical literacy as drivers of administrative efficiency in vocational colleges in Shanghai, China

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ABSTRACT

Under the framework of China's "Education Modernization 2035" strategy, digital transformation is a priority project of the vocational education strategy. However, many Shanghai colleges and universities have the problem of AI adoption, technical literacy, and low administrative efficiency when scheduling classes and managing resources. This study expands the TAM and AI-TPACK framework to explore the impact of artificial intelligence technology adoption on management efficiency. This study attempts to: 1) Investigate the current state of AI adoption in administrative efficiencies. 2) Evaluate the effect of AI adoption on administrative efficiency. and 3) to increase administrative efficiency in Shanghai's vocational colleges by effectively managing AI technology adoption. A stratified random sampling was conducted on the administrators of 9 vocational colleges (6 public and 3 private), and 315 valid questionnaires were obtained. AMOS was used to carry out a structural equation model (SEM) analysis. The results demonstrate that: 1) The adoption of AI technology impacted administrative efficiency (0.462), and 2) Technical literacy impacted administrative efficiency (0.315). The adoption of AI technology has impacted technical proficiency (0.512). The mediator role of Technical Literacy, mediated through the Adoption of AI Technology and Administrative Efficiency (0.185), is partially supported. This research contributes to the study of digital transformation in vocational education by showing that administrative efficiency depends on how well teachers' technical skills match the use of AI. It highlights that digital investments guided by governance and the development of competencies through practical scenarios are key to enabling effective collaboration between humans and AI.

Keywords: AI adoption, administrative efficiency, teachers' technical literacy, vocational colleges.

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INTRODUCTION

In the realm of higher education, the advent of Artificial Intelligence (AI) in education administration is a significant component of digital transformation. AI tools like machine learning, natural language processing, and predictive analytics are now widely adopted to enhance institutional management, automate administrative processes, and aid data-driven decision-making. Administrative efficiency is especially critical in vocational colleges, where institutions need to be agile and adaptable to labor market needs and industry shifts, handle extensive amounts of institutional data and processes, and respond proactively.

China has seen a rapid pace of smart education policy development, which has encouraged the use of AI in schools. The process of smart education policies has sped up China's AI usage in educational institutions. As a key city of technological innovation and educational modernization, Shanghai has actively promoted the digitalization of vocational education. Shanghai has actively driven the digital transformation of vocational education as one of the key cities for technological innovation and educational modernization. The Ministry of Education reported that there are over 300,000 students enrolled in over 50 vocational colleges in Shanghai. Administrative operations and institutional data have

become increasingly complex to handle using traditional management systems, thus the need for more efficient and technology-supported management practices.

The use of AI in education administration can provide benefits such as automated scheduling, resource management, student management, and communication within the institution. Previous research has demonstrated that AI-based management systems is able to lower operational error rate, increase decision-making precision, and boost organizational efficiency when compared to manual management systems (Dichev and Dicheva, 2021; Zainuddin et al., 2020). In addition, recent studies suggest that the digital transformation facilitated by AI also has a positive impact on the performance and effectiveness of institutions in the context of higher education (Qi and Rattanapun, 2024; Wang et al., 2025). Story and Tait, 2019

AI has emerged as a key enabler in digital transformation for educational administration and institutional governance, as highlighted by recent research. AI-powered systems can enhance the efficiency of an organization, automate repetitive administrative tasks, and support data-driven decision-making in the field of education (OECD, 2023; Zhai et al., 2021). Furthermore, the growing involvement of AI technologies in educational contexts places a demand on educational actors to acquire new digital skills and an AI-related literacy to interact with intelligent systems and to navigate fast-changing technological contexts (Holmes et al., 2019; Alam, 2023). The technological developments mentioned reveal the growing interconnections in today's educational administration between technical infrastructure and human competency.

Although there has been a rise in interest in the use of AI in the field of education, some research gaps still exist. First, most of the previous studies have been targeted at the teaching and learning applications of AI, but not the efficiency of administration in vocational colleges. Secondly, teachers' technical literacy has received less research focus as a key determinant of the successful implementation of AI systems in educational administration. Thirdly, limited empirical studies focus on AI applications and administrative efficiency in vocational colleges in Shanghai.

As such, this study aims to explore the impact of AI applications and the technical literacy of teachers on administrative efficiency in vocational education institutions in Shanghai, China. The results will be relevant to the literature on the use of artificial intelligence to manage education and will have practical implications for future management of effectiveness in vocational education institutions.

Research objectives

1. To investigate the current application status of Artificial Intelligence (AI) technology adoption in the administrative work of vocational colleges in Shanghai.
2. To evaluate the impact of AI technology adoption on the administrative efficiency of vocational colleges in Shanghai.
3. To propose a framework for improving administrative efficiency in Shanghai's vocational colleges through the effective management of AI technology adoption.

This framework combines technological readiness with professional capabilities to provide feasible insights for building a technology-driven environment. Finally, this approach aims to eliminate the obstacles of traditional management systems and meet the urgent needs of Shanghai for the development of a workforce with enhanced skills by improving institutional efficiency.

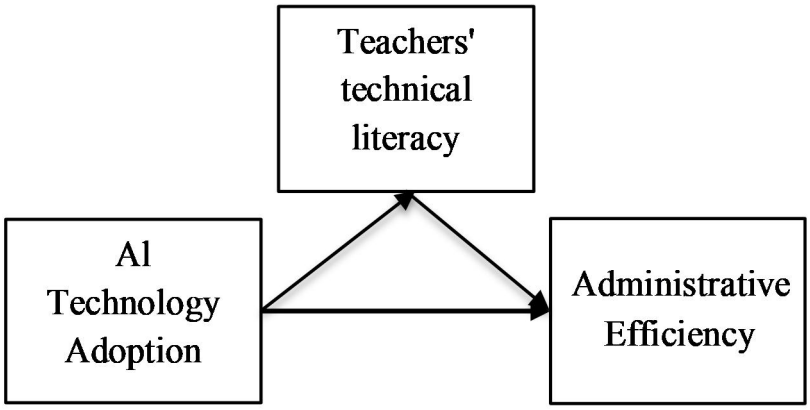

Figure 1. Conceptual framework.

LITERATURE REVIEWS

This study combines the Technology Acceptance Model (TAM) with the Artificial Intelligence Technology-Integrated Pedagogical Content Knowledge (AI-TPACK) to explore the relationship between artificial intelligence technology, technological literacy, and management efficiency. The TAM model indicates that the success of a system depends on users finding it useful and easy to use (Davis, 1989; Venkatesh et al., 2003). Therefore, the artificial intelligence infrastructure in vocational colleges needs to rely on the perception of managers to function. This theory supports the path of the research model: the artificial intelligence application environment is positively correlated with management efficiency (hypothesis 1) and is positively correlated with teachers' technological literacy (hypothesis 2). In addition, technological literacy is positively correlated with management efficiency (hypothesis 3) and is also a key mediating variable between technological potential and institutional output (hypothesis 4). According to the research on digital transformation, this framework holds that vocational education (voca ed) is related to the availability of technology and the complex literacy of human capital because of better management results (Wang and Zhao, 2023; Zainuddin and Keumala, 2020).

Relationship between AI technologies and administrative efficiency

"Enhanced intelligence" is the core of artificial intelligence in educational management (Luckin, 2020). To enhance organizational performance, Gartner (2023) points out that artificial intelligence - driven automation reduces redundant steps in public sector management. In vocational colleges in Shanghai, artificial intelligence optimizes resource allocation, speeds up information flow, reduces costs, and shortens response time (Gao and Sailer, 2022).

The impact is reflected through 3 mechanisms. First, automated systems such as RPA transform manual workflows such as registration and scheduling into immediate digital processes, eliminating human bottlenecks (Miao, 2021). Second, international assistants and such interactive tools handle routine consultations, freeing administrators from repetitive tasks. This transformation enables employees to focus on high-value strategic innovation rather than daily maintenance work. Finally, the synergistic effect of artificial intelligence improves speed, accuracy, and strategic focus, reshapes the management system of higher vocational colleges in Shanghai, and also has an impact on administrative efficiency.

H1: Artificial Intelligence (AI) Technologies have a positive impact on administrative efficiency in vocational colleges in Shanghai.

Relationship between AI technology adoption and technical literacy

The use of innovative digital tools in education has gradually become the norm, leading to the creation of new practices and new modes of competence construction in schools. The use of sophisticated digital tools has been gradually changing the ways in which work is done and competence is built in educational institutions. Selwyn (2022) explained that digital transformation alters and transforms the technological capabilities and professional roles of organizational members in educational settings. AI-based systems and digital management platforms are available in vocational colleges in Shanghai, which allows for ongoing interactions with digital technologies, potentially fostering technical literacy among teachers and digital competency (Bond et al., 2024).

The need for technological competency in enabling successful digital transformation in educational organisations has been highlighted in previous research. Ifenthaler and Yau (2020) emphasized the importance of being data literate and making decisions with the help of technology in digital environments. Likewise, Zhai et al. (2021) proposed that AI technologies not only enhance the efficiency of operations but also transform the professional practice and institutional management processes in education. Emerging research also suggests that the adoption of AI will be successful when technological systems and human capabilities interact, such as when teachers' digital skills and adaptability, and professional preparedness are at play (Alam, 2023; OECD, 2023; Falloon, 2020).

A constant interaction between teachers and AI-supported administrative systems may help to increase teachers' technological knowledge, digital awareness, and capacity to use intelligent technologies in institutional activities, from the perspective of AI-TPACK. The use of platforms equipped with AI can also minimize the technological barriers for implementation and enhance the perceived ease of use and usefulness of the platform, as postulated in the Technology Acceptance Model (TAM) (Davis, 1989). With the growing awareness of AI-backed systems, the trust and expertise among educators in using intelligent technologies could slowly rise.

Smart-campus projects and AI-based management systems in vocational schools in Shanghai can foster a technologically enriched environment that promotes lifelong learning and digital adaptation. Thus, it is hypothesized that AI Technology Adoption has a positive effect on Teachers' Technical Literacy in vocational colleges of Shanghai.

H2: Artificial Intelligence (AI) Technology adoption has a positive impact on Teachers' technical literacy in vocational colleges in Shanghai.

Relationship between technical literacy and administrative efficiency

The depth of digital governance efficiency is related to "human-machine coordination" (eff). The digital competence theory (Dig cap theory) shows that individual digital literacy (indiv tech lit) is the key to technological returns (Helsper, 2021). Managers with high AI-TPACK can efficiently manage schedules (sched) and perform tasks such as record keeping (rec keep); insufficient digital literacy will generate errors and biases, thereby reducing efficiency (Zawacki-Richter et al., 2024). Digital literacy affects management efficiency (eff) through these pathways. First, the basic artificial intelligence knowledge makes "technical hesitation" disappear. Due to being confident in mastering the basic artificial intelligence knowledge, the learning curve becomes shorter, and the dependence on technical support is reduced, so the work process of the institution is accelerated. Second, technology integration improves "execution accuracy." Skilled administrators act as "bridges" and use professional judgment to optimize algorithm output. Essentially, technical literacy is the "operating system" that activates the "hardware" of artificial intelligence. If the AI - TPACK is not improved, the potential of artificial intelligence is in a hidden state. The technical literacy of teachers will have a great impact on administrative efficiency.

H3: Teachers' technical literacy technologies have a positive impact on Administrative Efficiency.

The mediating role of technical literacy

The contributions of tech organizations often emerge through "indirect paths". The Extended Technology Acceptance Model (Ext TAM) indicates that technological innovation only impacts performance when users achieve internalization (Scherer et al., 2023). In the field of vocational education, artificial intelligence brings "possibilities", and teaching digital literacy transforms this "possibility" into "reality". Without this bridge, "digital friction" will occur, thereby undermining efficiency. Therefore, technical literacy is the connection between artificial intelligence technology and administrative efficiency.

There are 3 mechanisms in this kind of mediation. First, cognitive readiness is related to the impact of artificial intelligence on operational speed. Technological literacy is like a "gatekeeper", transforming the stimulation of artificial intelligence into behavioral intentions and preventing technology from becoming a tool of alienation. In conclusion, teacher technological literacy is not only a "catalyst" but also a key bridge to prevent the loss of technological potential and guide it to measurable institutional progress. This integrates the view that technological literacy plays an important mediating role in the impact of artificial intelligence on administrative efficiency.

H4: Mediating role of teachers' technical literacy impact between AI technology adoption and administrative efficiency.

RESEARCH METHODOLOGY

In this study, a mixed method was used to study the relationships between AI adoption, teachers' technical literacy and administrative efficiency in Vocational Colleges in Shanghai, China, by combining quantitative and qualitative methods. The quantitative phase was used to evaluate the proposed hypotheses, and the qualitative phase gave a context to the challenges of implementing AI and the experiences of institutions with this implementation.

The type of design used in the quantitative study was a cross-sectional survey design. The population consisted of administrative and teaching staff of 29 vocational colleges in Shanghai, among which there were 18 public colleges and 11 private colleges. To choose the nine colleges (six public and three private) that have active projects on smart campus and AI implementation, stratified purposive sampling was applied. The number of respondents was calculated based on the Yamane formula (1967) with a margin of error of 5% and a confidence level of 95%. Attendees were vice presidents, academic directors, and administrative personnel in charge of running the institution.

A structured questionnaire was developed based on existing research on the use of AI, digital transformation and education management. The instrument was made of 27 items with a 5-point Likert scale and categorised into three constructs, namely: AI Technology Application, Technical Literacy of Teachers, and Administrative Efficiency.

The content validity was checked by three experts using the Item-Objective Congruence (IOC) method, with an IOC value ranging from 0.67 to 1.00, which is acceptable. An initial sample of 30 respondents was administered a pilot survey before the main survey. The reliability test showed that there was good internal consistency, with Cronbach's alpha ranging from .847 to .892, and the overall alpha was .885.

In the qualitative phase, four school administrators were selected using purposive sampling, one of whom is the

head of the school's ICT department, and the remaining three are chairpersons of the school's ICT departments. The interviews focused on the challenges and experiences encountered, and the impact of AI on administrative effectiveness. The qualitative data were analysed using thematic analysis to complement and explain the quantitative data.

Data analysis was carried out using SPSS and Structural Equation Modeling (SEM), which was quantitative. Data analysis techniques were descriptive statistics, correlation, regression, Confirmatory Factor Analysis (CFA), and the SEM technique. The method used to analyze the data was descriptive statistics, correlation analysis, regression analysis, Confirmatory Factor Analysis (CFA), and SEM. The bootstrapping procedure (5000 resamples) was used to estimate mediation effects. Ethical clearance was obtained prior to data collection, and the participants' confidentiality, anonymity, and voluntariness were explained.

RESULTS

A total of 315 administrative personnel from nine vocational colleges in Shanghai participated in the study. The gender distribution of the respondents was 54.9% female and 45.1% male. The majority of respondents came from public vocational colleges (66.7%), and the age group with the highest number was 31 to 40 years (39.7%). The majority of workers (50.8%) were in general administrative occupations.

Table 1. Demographic characteristic (N = 315).

Demographic variables	Category	Frequency (n)	Percentage (%)
Gender	Male	142	45.1
	Female	173	54.9
Age	Under 30 years old	65	20.6
	31 – 40 years old	125	39.7
	41 – 50 years old	95	30.2
	Above 51 years old	30	9.5
Type of college	Public Vocational College	210	66.7
	Private Vocational College	105	33.3
Years of administrative experience	1 – 5 years	70	22.2
	6 – 10 years	110	34.9
	11 – 20 years	90	28.6
	Over 20 years	45	14.3
Position level	Senior Management	45	14.3
	Middle-level Manager	110	34.9
	General Administrative Staff	160	50.8

Descriptive analysis

The descriptive analysis indicated that respondents generally reported positive perceptions toward AI adoption, teachers' technical literacy, and administrative efficiency. Administrative Efficiency showed the highest overall mean score (M = 3.95, SD = 0.61), followed by AI Technology Adoption (M = 3.88, SD = 0.63) and Teachers' Technical Literacy (M = 3.88, SD = 0.66).

Level scale of AI technology adoption, teachers' technical literacy and administrative efficiency

The top-rated features comprised AI support for drafting and translating (M = 4.08), minimizing data entry errors using AI systems (M = 4.12), and knowledge of AI uses in educational management (M = 4.12). The insights indicate that the respondents saw potential benefits in AI technologies for managing institutions and making them more effective.

Table 2. AI technology teachers' technical literacy and administrative efficiency scale.

Questions	Mean	SD	Meaning
AI Technology	3.88	0.63	Agree
AI1. AI rules college course scheduling and classroom management.	3.82	0.65	Agree
AI2. College attendance and approval guaranteed.	3.95	0.58	Agree
AI3. Administrative office software sends regular work reports and reminders.	3.76	0.72	Agree
AI4. The college makes administrative decisions utilizing student learning data and AI algorithms.	4.02	0.55	Agree
AI5. AI report forecasts improve campus education.	3.88	0.61	Agree
AI6. AI finds administrative management operational difficulties early.	3.91	0.59	Agree
AI7. College students and faculty use AI chatbots for administrative requests.	3.65	0.78	Agree
AI8. Administrative professionals use AI-assisted drafting and translation for official documents.	4.08	0.52	Agree
AI9. Campus intelligent platform gives customized management data.	3.79	0.68	Agree
Administrative Efficiency	3.95	0.61	Agree
AE1.AI has greatly sped up administrative tasks.	3.92	0.61	Agree
AE2. Digital optimization speeds up student and faculty administrative responses.	4.05	0.55	Agree
AE3. AI-supported systems promote cross-departmental information transmission.	3.84	0.68	Agree
AE4. AI tools reduce data entry and record-keeping errors.	4.12	0.52	Agree
AE5. Resource allocation decisions (funding, staffing) are more exact.	3.89	0.63	Agree
AE6. Digital monitoring improves administrative policy consistency.	3.96	0.59	Agree
AE 7.AI has freed administrative personnel from tiresome physical labor, letting them focus on more complex tasks.	3.78	0.75	Agree
AE 8. AI made institution management cheaper.	4.01	0.57	Agree
AE9. Digital transformation has greatly increased administrative service quality and professionalism.	3.94	0.60	Agree
Teachers' Technical Literacy	3.88	0.66	Agree
TL1. I grasp basic AI ideas and functionalities.	3.88	0.61	Agree
TL2. I understand how AI can improve educational management.	4.12	0.54	Agree
TL3. I stay current on vocational education digital technology trends.	3.68	0.75	Agree
TL4. I can fix digital management platform issues.	3.62	0.79	Agree
TL5. I can optimize workflow with AI and institutional protocols.	3.81	0.66	Agree
TL6. I can efficiently use AI tools for administrative and management activities.	3.75	0.68	Agree
TL7. I can securely manage student and institutional data in AI-driven platforms.	4.05	0.58	Agree
TL8. I understand AI ethics and privacy in education.	3.96	0.63	Agree
TL9. I protect data using intelligent management tools and standard protocols.	4.10	0.55	Agree
Total	3.90	0.63	Agree

Correlation analysis

The analysis of correlation revealed that all the study variables have significantly positive relationships. Administrative Efficiency ($r = .685$, $p < .01$) was positively correlated with AI Technology Adoption, and Teachers' Technical Literacy ($r = .512$, $p < .01$) was also positively correlated with AI Technology Adoption. Administrative Efficiency was also positively correlated with Teachers' Technical Literacy ($r = .542$, $p < .01$).

Table 3. Pearson correlation coefficients.

Variables	AI technology	Technical literacy	Administrative efficiency
AI technology adoption	1		
Teachers' technical literacy	.512**	1	
Administrative efficiency	.685**	.542**	1

The findings indicate that higher levels of AI adoption and stronger technical literacy were associated with greater administrative efficiency in vocational colleges.

Multiple linear regression analysis

For testing the hypotheses for H1, H2, H3, and H4, this study used multiple linear regression analysis and mediation effect testing. This analysis was done in three phases. The direct effects of AI Technology Adoption on Administrative Efficiency and Teachers' Technical Literacy (H1 and H2) were first explored. Second, the effect of Teachers' Technical Literacy on Administrative efficiency was tested (H3). Lastly, the mediation of Teachers' Technical Literacy between the relationship of AI Technology Adoption and Administrative Efficiency was examined using bootstrapping analysis (H4).

Table 4. Regression and mediation analysis results.

Hypothesis	Statement	Standardized β	Result
H1	AI Technology Adoption → Administrative Efficiency	.462	Supported
H2	AI Technology Adoption → Teachers' Technical Literacy	.512	Supported
H3	Teachers' Technical Literacy → Administrative Efficiency	.315	Supported
H4	AI Technology Adoption → Teachers' Technical Literacy → Administrative Efficiency (Mediation)	.185	Supported

All the hypotheses proposed were statistically supported, as shown in Table 4. Administrative Efficiency ($\beta = .462$, $p < .001$) was of a strong positive association with AI Technology Adoption, which suggests that the use of AI technology is related to higher levels of operational efficiency within the institutions.

The effect of that AI Technology Adoption on Teachers' Technical Literacy was also significant with a positive value, $\beta = .512$, $p < .001$. The study indicates that increased exposure to AI-supported systems helped to strengthen the digital and technical skills of educational personnel.

Besides that, Teachers' Technical Literacy proved to be significantly related to the Administrative Efficiency at the level $\beta = .315$, $p < .001$, meaning that the more technically competent the teachers, the more effective their administrative performance.

The mediation analysis also showed that the relationship between AI Technology Adoption and Administrative Efficiency was mediated by part of the Teachers' Technical Literacy ($\beta = .185$, $p < .01$). The indirect effect was statistically significant, suggesting that the use of AI also indirectly contributed to the improvement in administrative efficiency via the increase in technical literacy of teachers. Overall, the results show that technical skills are a crucial factor in the successful implementation of AI in vocational college administration.

Structural equation modeling results

This section shows the results of hypothesis testing using Structural Equation Modeling (SEM) AMOS. SEM was used to investigate the relationships among AI Technology Adoption, Teachers' Technical Literacy, and Administrative Efficiency. The analysis was conducted in two phases – the measurement model and the structural model.

Model fit indices

The goodness-of-fit indices were used to assess how well the structural model fit. The results showed a good fit between the model and the data observed. The ratio of the chi-square to the degrees of freedom (χ^2/df) was less than the recommended value of 3.00, suggesting that the model was not overly complex. The Comparative Fit Index (CFI = 0.94) and Tucker–Lewis Index (TLI = 0.92) were both above the recommended value of 0.90, indicating good incremental model fit. Furthermore, the Root Mean Square Error of Approximation (RMSEA = 0.052) and Standardized Root Mean Square Residual (SRMR = 0.041) were smaller than the acceptable value of 0.08, suggesting a good model fit.

The overall results of SEM showed that the proposed structural model was able to describe the observed data.

Table 5. Model Fit Indices for SEM.

Fit index	Recommended value	Model value
χ^2/df	< 3.00	2.18
CFI	> 0.90	0.94
TLI	> 0.90	0.92
RMSEA	< 0.08	0.052
SRMR	< 0.08	0.041

As shown in Table 5, all model fit indices met the

commonly accepted academic criteria. The χ^2/df value of 2.18 indicated acceptable model parsimony, while the CFI and TLI values demonstrated satisfactory incremental fit. Furthermore, the RMSEA and SRMR values were below the recommended threshold of 0.08, indicating low approximation error and strong overall model fit. These findings support the adequacy of the structural model for evaluating the proposed relationships among the study variables.

Structural model and direct effects

The structural model revealed that there were important relationships between the study variables. The effect of AI Technology Adoption on Administrative Efficiency was also significant and positive, with a β value of .462 ($p < .001$), suggesting that AI-supported systems contributed to increased efficiency in the operations of the institutions. AI Technology Adoption also had a significant impact on Teachers' Technical Literacy (β = .512, $p < .001$), implying that more contact with AI systems correlated with higher technical literacy for teachers. Moreover, Teachers' Technical Literacy was found to have a positive influence on Administrative Efficiency (β = .315; $p < .001$), meaning that the more technically competent teachers were more effective in administrative matters. In addition, the mediation analysis showed that Teachers' Technical Literacy partially mediated the relationship between the variables of AI Technology Adoption and Administrative Efficiency (β = .185, p = .001). These results indicate that the use of AI leads to increased administrative efficiency, in both direct and indirect ways, by boosting technical literacy.

Table 6. Standardized direct effects in the structural model.

H	Path relationship	Standardized β	p-Value	Result
H1	AI Technology Adoption → Administrative Efficiency	.462	< .001	Supported
H2	AI Technology Adoption → Teachers' Technical Literacy	.512	< .001	Supported
H3	Teachers' Technical Literacy → Administrative Efficiency	.315	< .001	Supported
H4	AI Technology Adoption → Teachers' Technical Literacy → Administrative Efficiency	.185	.001	Partial Mediation Supported

All of the proposed hypotheses were confirmed by the SEM results. AI Technology Adoption positively influenced Administrative Efficiency (β =.462, $p < .001$) and so increased support for H1. Additionally, Teachers' Technical Literacy (β = 0.512, $p < .001$) significantly affected by AI Technology Adoption was in favor of H2. Further, Teachers' Technical Literacy positively influenced Administrative Efficiency (β = .315, $p < .001$), which therefore supports H3.

Mediating effects of teachers' technical literacy

The study used a bootstrapping method with 5,000 resamples to explore the mediating role of "Teachers' Technical Literacy" between the relationship between "AI Technology Adoption" and "Administrative Efficiency". The results indicated that the indirect effect was statistically significant and the 95% confidence interval was not 0, which indicated that there was an effect of mediation.

The results showed that the relationship between AI Technology Adoption and Administrative Efficiency was partially mediated by Teachers' Technical Literacy, aiding in the confirmation of hypothesis H4. The discovery suggests that AI can not only improve the technology but also develop employees' digital and technical competencies.

The results of this study indicate that the implementation of AI in the operation of vocational colleges will rely on the technological infrastructure, along with the technical competence of the teaching staff. As teachers and administrators become more proficient in their technical expertise, they can more effectively leverage the AI-driven systems and effectively run the institute.

Qualitative findings

Four school administrators (One ICT department head, three department chairpersons) were purposively selected for semi-structured interviews in the qualitative phase. The interviews covered experiences, challenges, and perceptions about AI Technology Adoption and Administrative Efficiency.

Thematic analysis identified three main themes. Participants noted that AI-driven systems enhanced administrative productivity by minimizing repetitive and manual tasks, streamlining data processing, and aiding decision-making. Second, participants highlighted the critical need for Teachers' Technical Literacy in effectively utilizing AI, noting that well-informed and digitally competent teachers were more successful in the integration of AI environments. Second, it was reiterated

that a key aspect of being effective in using AI was the Technical Literacy of the teachers, with those with a stronger understanding of digital tools being better able to work in AI-supported systems. Third, several barriers were discussed, such as different levels of digital competence of staff, a lack of technical skills training, and a lack of interest in change within the organization.

In general, the qualitative results affirmed the quantitative results, showing that the AI Technology Adoption positively promoted Administrative Efficiency, and Teachers' Technical Literacy was a vital factor in the effective digital transformation of vocational colleges in Shanghai.

DISCUSSION

The relationships among AI Technology Adoption, Teachers' Technical Literacy, and Administrative Efficiency in vocational colleges of Shanghai, China, were explored in this study. The results of Structural Equation Modeling (SEM) analysis indicated that the variables of Artificial Intelligence Technology Adoption significantly affected Administrative Efficiency, and the variable of Technical Literacy among Teachers was found to have an important mediating role between Artificial Intelligence Technology Adoption and Administrative Efficiency.

AI technology adoption and administrative efficiency

The results of the findings showed that AI Technology Adoption had a highly significant positive effect on Administrative Efficiency ($\beta = .462$, $p < .001$). The finding reflects the potential of AI-powered technologies, like intelligent scheduling, automated administration platforms, and data-driven management systems, in enhancing vocational college efficiency. The results validate the Technology Acceptance Model (TAM), and specifically perceived usefulness, which implies that the adoption of AI technologies among educational personnel is more likely when they believe that there are clear benefits for improving performance in their work and administrative tasks.

The findings align with past research that underscores the importance of AI and administrative automation in boosting organizational efficiency and eliminating repetitive tasks (Venkatesh et al., 2003; Zhang and Aslan, 2021). AI-driven systems can be more efficient at handling large amounts of institutional data, minimizing delays in operations and aiding quicker decision-making in education administration.

But this study expands previous studies by showing a relatively stronger linkage between AI adoption and administrative efficiency in vocational colleges in Shanghai. In previous research conducted within the higher education sector, issues of technological resistance and digital readiness of employees were generally reported. The current results, however, indicate a relatively high degree of acceptance and effectiveness of using AI in education among education stakeholders. The difference might be attributed to the high level of smart-campus development and digital transformation efforts undertaken in vocational colleges in Shanghai. The results suggest that highly digitalised institutional settings can enhance the effectiveness of administrative systems in vocational education settings with the support of AI.

Teachers' technical literacy and administrative efficiency

The results indicated that the Teachers' Technical Literacy significantly positively affected Administrative Efficiency ($\beta = .315$, $p < .001$). The outcome underscores the crucial importance of human competence in enabling successful digital transformation in vocational education institutions. The results indicate that technical literacy is not just limited to using software but also encompasses the capacity to effectively leverage AI-enabled systems, understand digital data, and integrate technology into administrative decision-making procedures.

The findings support the findings of previous studies that highlight the importance of human capability and digital competency in organizational digital transformation (Nishimura, 2022; Wang and Zhao, 2023). AI-informed administrative systems are increasingly becoming the norm, and educational personnel with better technical understanding are better able to adjust to this and use digital tools to enhance the efficiency and effectiveness of their institutions.

Furthermore, this study will build on existing research by emphasizing the growing significance of the competencies related to AI in vocational education administration. The present results suggest that in a highly AI-supported learning environment, specific skills pertaining to AI-supported systems and AI-based decision-making are gaining in significance beyond the mere general skills in ICT. The results also indicate that there is a possibility for the development of a better match between staff's digital skills and technology systems that are rapidly changing in vocational colleges in Shanghai through continuous PD and technical training.

AI technology adoption and teachers' technical literacy

The results indicated that AI Technology Adoption had a significant and positive impact on Teachers' Technical Literacy ($\beta = .512$, $p < .001$). This finding indicates that the more contact with AI-supported systems and digital

platforms, the more technical skills educational workers acquire. The relatively high path coefficient suggests that AI-based environments can enable ongoing vocational education institution development and adaptation.

Results are in line with the connectivism theory (Siemens, 2005), which suggests that learning takes place in a dynamic digital network through interaction in technology-supported environments. Frequent encounters with the AI-supported administrative systems and intelligent platforms in vocational colleges in Shanghai can stimulate educational staff members to constantly acquire digital skills and technological knowledge.

The findings also resonate with prior research, which supports the effect of immersive digital environments and systems supported by technology in improving professional growth and operations (Zainuddin and Keumala, 2020; Zhang and Aslan, 2021). The results indicate that AI technologies not only serve as administrative tools but also as a means of fostering technical skills and digital competence.

This study's results revealed that the technical literacy of teachers was a relatively strong factor influencing the relationship between AI Technology Adoption and the adoption of AI in higher education institutions, compared with previous studies conducted in traditional higher education institutions. This gap might relate to the very digitalized smart campus and the persistent support for digital transformation in vocational colleges in Shanghai. Unlike other earlier research that has raised concerns about the stress that can be caused by technology (Kalkbrenner, 2023), the present results indicate that institutional environments that empower education personnel and provide ongoing professional development can facilitate better adaptation to the introduction of AI-supported systems.

The mediating role of teachers' technical literacy

The results found that the relationship between AI Technology Adoption and Administrative Efficiency was significantly mediated by Teachers' Technical Literacy ($\beta = .185$, $p < .01$). The findings show that technology is not enough to make AI effective in vocational college administration; technical skills of educational personnel play a significant role in its effectiveness. This means that AI-integrated systems are more effective when teachers and administrators have adequate digital knowledge and technical proficiency to effectively leverage these technologies.

The results found corroborate the socio-technical system theory, which focuses on the interaction between technology systems and human capabilities in an organization. The findings indicate that AI technologies do not necessarily result in enhanced institutional efficiency without the involvement of educational personnel who can incorporate the technology into administrative actions and decision-making processes.

The results of the present study are consistent with the results of earlier studies that have emphasised the importance of human competency to maximise the benefits of digital transformation (Nishimura, 2022; Wang and Zhao, 2023). As in these studies, the present study shows that technological competency is a key factor in linking technological implementation to organizational performance outcomes.

This study also advances the previous research by proving the sequential relationship of AI Technology Adoption, Technical Literacy of Teachers, and Administrative Efficiency in Vocational Education Institutions, which has not been empirically proven in previous research. The findings of the present investigation suggest that both aspects of technology and human competencies are linked and working together in highly digitalized educational contexts, rather than as studied in other research that tended to isolate one aspect of technology or human competencies. The findings also indicate that the effectiveness of the vocational college's administrative system, supported by the AI, can be enhanced through continuous professional development and technical training.

Conclusion

A study was conducted on 315 teachers in higher vocational colleges in Shanghai using structural equation modeling (SEM). To explore the logical relationship among the application of artificial intelligence technology adoption, teachers' digital literacy, and management efficiency. Four core conclusions: First, the application of artificial intelligence technology adoption is the main external driving factor for the modernization of management efficiency (H1: $\beta = .462$, $p < .001$). Daily scheduling, financial reimbursement, and the artificial intelligence-assisted office intelligent platform simplify traditional work processes and process data in real time. This process (reeng) can reduce labor costs, improve the throughput and response speed of the organization. Secondly, the technical literacy of teachers is relatively important for the organizational efficiency (H2: $\beta = .385$, $p < .001$). In a high-tech environment, "people" are still the core of output. High-quality employees can discover the value of tools, master complex algorithms, and reduce obstacles in the operation process. They transform raw artificial intelligence data into scientific decisions, enabling the investment in science and technology to develop in the direction of institutional quality. The third artificial intelligence adoption helps the iterative improvement of scientific and technological literacy (H3: $\beta = .512$, $p < .001$). The immersive learning environment (env) is an advanced digital campus. Daily interaction with intelligent

systems requires frequent skill updates. "Situated learning" enables teachers to enhance their skills in the process of solving problems and brings a positive feedback loop to the performance of the organization (org). The mediating role of the fourth technical literacy (tech literacy) is obvious (H4: $\beta = .198$, $p < .001$), which is the bridge of "technological dividend"."Human-machine collaboration" is the core of digital transformation. Artificial intelligence adoption has potential in terms of efficiency, and teacher literacy is the key to transforming this potential into actual output. Without human promotion, technology is like an expensive decoration; only in-depth human-machine synergy can there be a state of sustainable management.

RECOMMENDATION

Based on the empirical findings of this study regarding vocational colleges in Shanghai, and in order to further optimize the application effects of AI technology adoption while releasing the mediating potential of teachers' technical literacy, the following recommendations are proposed:

Research contribution

The results of this study confirm the preset academic hypothesis, and also bring profound insights to the theoretical and practical levels of the digital transformation of vocational education.

Theoretically, this study introduces a new cognitive framework for educational management:
First, it expands the theory of the extended socio-technical system, where the technical and social subsystems are deeply coupled. It verifies the mediating effect of technological literacy, confirms the mutual dependence between technology and people, and thus obtains the transformation to evaluate the human-machine collaboration system. Secondly, it refutes technological determinism, and the literacy of the efficiency improvement factors is activated. This explains the performance differences under the same investment and also emphasizes the catalytic role of human capital. Finally, this research models the organization digitally, clarifies that artificial intelligence adoption has an environment-driven effect, reshapes individual behavior and organizational performance, and enriches the interdisciplinary research of educational technology and management psychology.

Practical Implications, this study provides a strategic guide for vocational education and vocational training (voca col) managers: 1). Shift from "simply focusing on hardware" to balanced governance. Due to blind investment leading to "technology being idle", digital budgeting needs to first focus on the construction of digital resources and capabilities, and also take hardware into account. At the same time, balancing "machine intelligence" (machine intell) and "human capabilities" (human cap) is very important for improving efficiency. 2). Adopt a "scenario-driven" capability building model. Replace general lectures with training that "embeds tasks" in it, so that "learning by doing" can be realized in the actual work process, seize the "mediation value" (mediation div), and speed up the "benefit generation" (benefit gen). Finally, build a human-machine collaborative evaluation mechanism. Transform the indicators from the quantity level to the direction of artificial intelligence-driven process optimization, ease the anxiety in terms of technology, release employees' creativity to formulate strategic plans, and also enhance the awareness in terms of the organization.

Future research

Given the rapid advancement of AI technology, future research could explore the following dimensions:

1. Compare empirical research across regions and types. This study focuses on vocational colleges in Shanghai, an economically developed region. Regional educational resources are uneven. Future research must determine whether artificial intelligence technology adoption affects administrative efficiency in central and western China differently. To test the model's universality, compare vocational undergraduate schools, higher vocational colleges, and undergraduate vocational universities' digital transformation routes.

2. Investigate the "psychological black box" with qualitative methodologies. We employ the quantitative method to analyze the structural relationship between variables. Future research can use in-depth interviews, participant observation, or ethnography to study teachers' psychological reaction (technical stress) to artificial intelligence substitution and its negative moderating influence on managerial efficiency. This qualitative supplement aids managers in humanizing transformation methods.

3. Conduct AIGC and Large Language Model longitudinal tracking experiments, generative AI (e.g., ChatGPT, Deepseek Large Language Models) is transforming vocational education administration. Future research should focus on how this "disruptive innovation" redefines the connotation of "teachers' technical literacy" and, through longitudinal tracking studies, observe the dynamic matching patterns between the long-term stability of administrative efficiency improvement and technological iteration.

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Conflict of interest

The authors declare no conflict of interest.

Ethical consideration

This study was conducted in accordance with academic research ethics and approved by the related institutional research procedures. Participation in the survey was voluntary, and all respondents were informed of the purpose of the study. Confidentiality and anonymity of participants were strictly maintained throughout the research process.

REFERENCES

Alam, A. (2023). Possibilities and apprehensions in the landscape of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 4*, 100151. https://doi.org/10.1016/j.caeai.2023.100151

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2024). A systematic review of professional development for digital education in vocational training. *Journal of Educational Research, 117*(2), 88–105.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/10.2307/249008

Dichev, C., & Dicheva, D. (2021). AI in education: Challenges and opportunities for the administrative domain. *Journal of Educational Computing Research, 59*(4), 1–22. https://doi.org/10.1177/0735633120985836

Falloon, G. (2020). From digital literacy to digital competence: The role of teacher professional development. *Journal of Research on Technology in Education, 52*(3), 448–472. https://doi.org/10.1080/15391523.2020.1746238

Gao, P., & Sailer, M. (2022). Artificial intelligence-supported educational administration and resource optimization in higher education institutions. *Educational Technology Research and Development, 70*(5), 2145–2163. https://doi.org/10.1007/s11423-022-10145-7

Gartner. (2023). *Top strategic technology trends for 2023: Applied artificial intelligence in public sector management*. https://www.gartner.com/en/information-technology

Helsper, E. J. (2021). *The digital disconnect: The social causes and consequences of digital inequalities*. SAGE.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Ifenthaler, D., & Yau, J. Y.-K. (2020). Utilising learning analytics for study success: Reflections on current empirical findings. *Research and Practice in Technology Enhanced Learning, 15*(1), 1–17. https://doi.org/10.1186/s41039-020-00135-7

Kalkbrenner, M. T. (2023). Alpha, omega, and beyond: Reporting the reliability of academic measurements. *Journal of Counseling & Development, 101*(1), 1–10. https://doi.org/10.1002/jcad.12463

Luckin, R. (2020). *Enhancing learning and teaching with artificial intelligence: What the research says*. UCL Institute of Education Press.

Miao, F. (2021). *Artificial intelligence and education: Guidance for policy-makers*. UNESCO Publishing. https://unesdoc.unesco.org/

Nishimura, K. (2022). Human-centered digital transformation in educational organizations: The mediating role of technological competencies. *Educational Management Administration & Leadership, 50*(6), 945–962. https://doi.org/10.1177/17411432211015211

OECD. (2023). *OECD digital education outlook 2023: Towards an effective digital education ecosystem*. OECD Publishing. https://doi.org/10.1787/b2715bba-en

Qi, Y., & Rattanapun, S. (2024). Optimizing education: How dual teacher technology, communication, and decision-making drive performance? *Journal of Information Systems Engineering and Management, 9*(4), 27381. https://doi.org/10.52783/jisem.v9i4.27381

Scherer, R., Siddiq, F., & Tondeur, J. (2023). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology. *Computers & Education, 192*, 104658. https://doi.org/10.1016/j.compedu.2022.104658

Selwyn, N. (2022). *Education and technology: Key issues and debates* (3rd ed.). Bloomsbury Academic.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning, 2*(1), 3–10.

Story, D., & Tait, A. (2019). Digital capability and transformation in educational institutions: Emerging models and practices. *Journal of Educational Administration, 57*(5), 567–582. https://doi.org/10.1108/JEA-12-2018-0235

UNESCO. (2021). *Artificial intelligence and education: Guidance for policy-makers*. UNESCO Publishing. https://unesdoc.unesco.org/

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.2307/30036540

Wang, H., Rattanapun, S., & Taweedech, T. (2025). Digital transformation in higher education: A TOE framework analysis of technology adoption, dynamic capabilities, and university performance. *Scientific Culture, 11*(3.1), 321–332. https://doi.org/10.5281/zenodo.11032527

Wang, Y., & Zhao, L. (2023). Artificial intelligence adoption and organizational performance in higher education: The mediating role of digital competence. *Computers and Education: Artificial Intelligence, 4*, 100134. https://doi.org/10.1016/j.caeai.2023.100134

Zainuddin, Z., & Keumala, C. M. (2020). Blended learning method within Indonesian higher education institutions: The relationship between institutional support, technological literacy, and learning effectiveness. *Education and Information Technologies, 25*(3), 1475–1491. https://doi.org/10.1007/s10639-019-10098-1

Zawacki-Richter, O., Bond, M., Marín, V. I., & Gouverneur, F. (2024). Systematic review of artificial intelligence applications in higher education administration and teaching. *International Journal of Educational Technology in Higher Education, 21*(1), 15–37. https://doi.org/10.1186/s41239-024-00412-7

Zhai, X., Chu, X., Chai, C. S., Jong, M. S.-Y., Istenic, A., Spector, M., Liu, J.-B., Yuan, J., & Li, Y. (2021). A review of artificial intelligence (AI) in education from 2010 to 2020. *Complexity, 2021*, 8812542. https://doi.org/10.1155/2021/8812542

Zhang, W., & Aslan, A. B. (2021). AI technologies for education: Recent research and future directions. *Computers and Education: Artificial Intelligence, 2*, 100025. https://doi.org/10.1016/j.caeai.2021.100025

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