

Predicting teaching competency in the AI era: The comparative roles of AI literacy, digital practices and institutional support

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ABSTRACT

This study examines the predictive effects of Teacher AI Literacy (TAL), Digital Teaching Practice (DTP), and Institutional Support (IS) on English Teaching Competency (TC) among vocational college teachers in Nanning, Guangxi, China. Data were collected from 303 teachers using a structured questionnaire and analyzed through descriptive statistics, correlation analysis, and multiple regression in SPSS. The results indicate that the model explains 51.2% of the variance in teaching competency. Among the predictors, Digital Teaching Practice demonstrates the strongest effect ($\beta = 0.438$), followed by Teacher AI Literacy ($\beta = 0.245$) and Institutional Support ($\beta = 0.201$). These findings confirm that actual pedagogical implementation plays a more critical role in competency development than technological availability or institutional provisions. The study contributes to the application of Social Cognitive Theory in AI-integrated education by highlighting the dominant role of behavioral factors. Practically, it suggests that vocational institutions should prioritize practice-oriented professional development over infrastructure-focused investment strategies.

Keywords: AI literacy, teaching competency, digital practices, institutional support, artificial intelligence in education (AIED), vocational education.

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INTRODUCTION

AI integration into education is a key technique for improving teaching and learning, especially in vocational education. The integration of artificial intelligence (AI) into the educational process has rapidly evolved from a supplementary tool to a transformative force in teaching, learning, and organizational practices. Recent studies indicate that AI technologies are reshaping educational processes by enabling personalized learning and restructuring higher education systems at multiple levels (Crompton and Burke, 2023; Hwang et al., 2020). In addition, generative AI significantly expands both opportunities and challenges related to knowledge creation, academic integrity, and educational decision-making (Dwivedi et al., 2023; Mishra et al., 2023). These developments suggest that AI implementation is not merely technological but represents a systemic

transformation requiring alignment among pedagogy, institutional strategy, and teacher competence. Chinese efforts like the "Double High Plan" have increased digital infrastructure investment to improve teaching quality and institutional competitiveness (State Council of China, 2019; Wang et al., 2025). Thus, many vocational institutions, particularly in Western China, have improved their technological availability and AI-supported tool access.

However, technical infrastructure advances have not always improved instructional competency. The "IT productivity paradox," where technological expenditure does not necessarily improve performance, is a larger issue in digital education (OECD, 2021). Since vocational EFL teachers must understand and integrate AI tools into their teaching, this gap is very apparent.

Teacher AI Literacy (TAL), which measures teachers' cognitive understanding of AI, Digital Teaching Practice (DTP), which shows how AI is used in teaching, and Institutional Support (IS), which includes organizational resources and policies that support technology use, have been found to influence teaching competency in the digital era. These elements have been studied separately, but their comparative effects on vocational education in Western China are yet unknown.

Understanding these factors' relative importance might improve policy and professional development plans, closing this gap is crucial. It is uncertain whether instructors' knowledge (TAL), classroom practices (DTP), or institutional factors (IS) promote teaching competency. Educational institutions may emphasize infrastructure investment without improving teaching outcomes without this comparative perspective.

This study compares the predictive impacts of Teacher AI Literacy, Digital Teaching Practice, and Institutional Support on vocational college instructors' English teaching competency in Nanning, Guangxi. This quantitative study uses multiple regression analysis to determine the most important element affecting teaching ability in the AI era.

This research is significant in two ways. Intended to extend Social Cognitive Theory, it empirically tests the relative contributions of personal (TAL), behavioral (DTP), and environmental (IS) aspects in technology-integrated instruction. It supports school administrators and policymakers in shifting from infrastructure-focused investment to practice-oriented teacher development initiatives with evidence-based guidance. This study also

responds to recent calls for more context-specific evidence on AI integration in vocational education systems. This study addresses these gaps by providing a comparative empirical analysis of personal, behavioral, and environmental factors, thereby extending Social Cognitive Theory in the context of AI-integrated vocational education.

Research questions

1. What is the predictive impact of Teacher AI Literacy (TAL) on the English teaching competency of vocational teachers in Nanning?
2. What is the predictive impact of Digital Teaching Practice (DTP) on the English teaching competency of vocational teachers in Nanning?
3. What is the predictive impact of Institutional Support (IS) on the English teaching competency of vocational teachers in Nanning?

Research hypothesis

- H1: Teacher AI Literacy (TAL) has a significant positive effect on English Teaching Competency.
- H2: Digital Teaching Practice (DTP) has a significant positive effect on English Teaching Competency.
- H3: Institutional Support (IS) has a significant positive effect on English Teaching Competency.

Conceptual framework

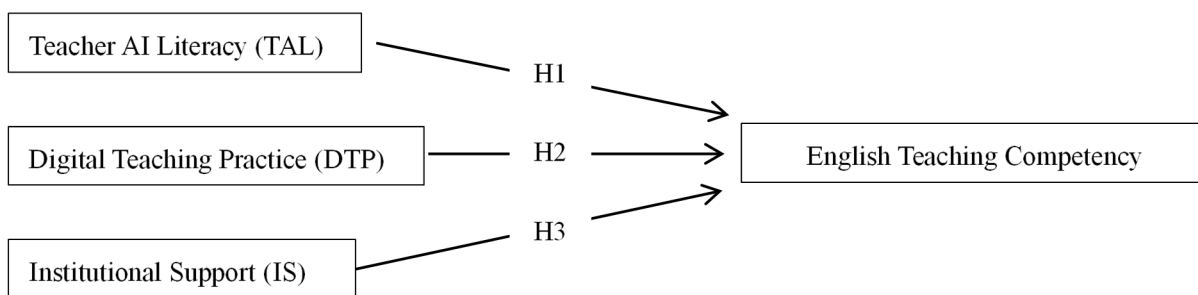


Figure 1. Conceptual framework.

LITERATURE REVIEWS

We base this work on Social Cognitive Theory (SCT) (Bandura, 1986), which explains human behavior through

the dynamic interaction of personal, behavioral, and environmental elements. AI-integrated teaching involves human (cognitive) factors like Teacher AI Literacy (TAL), behavioral factors like Digital Teaching Practice (DTP),

and environmental factors like Institutional Support (IS). SCT shows that these three areas interact to generate teaching competency. The key constructs in this study are defined as follows for conceptual clarity:

Teacher AI Literacy (TAL) refers to teachers' ability to understand, evaluate, and ethically apply AI tools in educational contexts, including prompt design, content validation, and responsible usage (Ng et al., 2023; Wang et al., 2023).

Digital Teaching Practice (DTP) refers to the actual implementation of AI and digital tools in teaching activities, including lesson design, assessment, and student interaction (Chiu, 2024; Ouyang and Jiao, 2021; Bearman et al., 2020).

Institutional Support (IS) refers to the availability of organizational resources such as infrastructure, policies, training, and technical support that facilitate technology integration (Scherer et al., 2021; Simatupang et al., 2025). Teaching Competency (TC) refers to teachers' ability to effectively design, deliver, and evaluate instruction in digital learning environments (OECD, 2021).

Within this framework, this study examines how these three factors differentially contribute to teaching competency.

Simultaneously, the integration of artificial intelligence (AI) into the teaching process has been closely associated with the development of teachers' digital competence and instructional practices. Previous studies suggest that AI literacy, technology acceptance, and teaching practices are structurally interconnected, and successful integration requires both cognitive understanding and practical application (Dong et al., 2020). This aligns with broader conceptualizations of digital competence, which emphasize the integration of technical, pedagogical, and ethical capabilities in technology-enhanced teaching (Falloon, 2020). Furthermore, the shift toward online and AI-supported learning environments highlights the importance of pedagogical design and instructional quality rather than mere technology use (Hodges et al., 2020; Kohnke and Moorhouse, 2023). Empirical evidence also indicates that teachers' perceptions and use of AI tools, including generative AI applications, significantly influence teaching effectiveness and student outcomes (Mohamed, 2024; Su and Yang, 2024). Therefore, effective technology integration is increasingly understood as a dynamic interaction among teacher competence, instructional practice, and learning outcomes (Zhao et al., 2021).

Relationship between Teacher AI literacy and Teaching Competency

Research consistently identifies Teacher AI Literacy as a key cognitive resource for technology integration. AI-literate teachers can better evaluate AI-generated

information, construct adaptable educational materials, and maintain ethical standards (Ng et al., 2023; Baidoo-Anu and Ansah, 2023). These competencies are essential for AI safety and pedagogy. However, empirical studies show a major drawback. AI literacy does not ensure classroom success, according to several studies (Wang et al., 2023). The knowledge–practice gap shows that teachers understand but fail to apply their information. Social Cognitive Theory explains this conflict by distinguishing personal characteristics (knowledge) from behavioral enactment. Without active application, TAL gives cognitive readiness, but not enough. So, TAL is a core but indirect driver of teaching skills. From this synthesis, the following hypothesis is proposed:

H1: Teacher AI Literacy (TAL) has a significant positive effect on English Teaching Competency.

Relationship between Digital Teaching Practice and Teaching Competency

The behavioral part of SCT, Digital Teaching Practice, is widely recognized as the fastest driver of professional competency. Teachers who actively use digital tools have stronger pedagogical adaptability, student engagement, and instructional success (Chiu, 2024; Tai and Chen, 2020). DTP measures teaching behavior, not potential, hence it is more directly related to performance outcomes than AI literacy. Repeated use of AI tools improves instructors' abilities to create interactive learning experiences and manage complicated classroom dynamics (Rattanapun et al., 2026; Ouyang and Jiao, 2021). Importantly, the literature agrees that practice modulates the effect of knowledge on performance. This supports the SCT idea that behavioral factors determine outcomes most directly. Thus, DTP should predict teaching competency best.

H2: Digital Teaching Practice (DTP) has a significant positive effect on English Teaching Competency.

Relationship between Institutional Support and Teaching Competency

Institutional support is crucial to SCT's environment. Prior research shows that infrastructure, training, and policy support can help instructors adopt technology and reduce anxiety (Scherer et al., 2021; Simatupang, 2025). However, the literature shows inconsistency. Sometimes institutional assistance has no direct impact on teaching competency, despite its substantial availability (Zawacki-Richter et al., 2024). This shows a "support–usage gap," where resources are available but underutilized. Environmental variables indirectly explain this from an

SCT perspective. Institutional support generates enabling conditions, but instructors must use them. Thus, IS facilitates expertise rather than driving it.

H3: Institutional Support (IS) has a significant positive effect on English Teaching Competency

Overall, the literature shows that Teacher AI Literacy, Digital Teaching Practice, and Institutional Support affect teaching competency. However, three major holes remain. First, previous studies examined these characteristics separately without evaluating their predictive power. Second, vocational education research in Western China, where the digital transition is rapid, is scarce. Third, Social Cognitive Theory is often mentioned, but few empirical models compare personal, behavioral, and environmental aspects.

This study compares TAL, DTP, and IS on teaching competency to fill these gaps. It helps explain how teaching competency evolves in the AI era.

RESEARCH METHODOLOGY

This study employed a quantitative cross-sectional research design to examine the predictive relationships between Teacher AI Literacy (TAL), Digital Teaching Practice (DTP), Institutional Support (IS), and Teaching Competency (TC). A survey method was used to collect standardized data, enabling statistical analysis of relationships among variables. The target population consisted of vocational English as a Foreign Language (EFL) teachers in Guangxi, China, with an estimated population size of $N = 1,250$ teachers across 20 vocational institutions. The required sample size was calculated using Yamane's (1967) formula with a 95% confidence level and a 5% margin of error, resulting in a minimum sample size of $n = 303$. A multi-stage sampling approach was employed: 1) Institution Selection: Twenty vocational colleges were selected using purposive sampling, based on their participation in digital or AI-supported teaching initiatives. 2) Participant Selection: Within each institution, teachers were selected using simple random sampling from available staff lists.

The inclusion criteria were: 1) Currently employed as EFL teachers, 2) Minimum of one year teaching experience, 3) Experience using digital or AI tools in teaching. A total of 303 valid responses were obtained and used for analysis.

Data were collected using a structured questionnaire adapted from previously validated scales in the literature. All measurement items were assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), ensuring consistency and comparability across constructs.

The instrument comprised four key constructs. First, Teacher AI Literacy (TAL) was measured using eight items

adapted from Ng et al. (2023) and Wang et al. (2023). This construct captured three dimensions: (1) AI knowledge and understanding, reflecting teachers' conceptual awareness of AI systems; (2) AI application skills, referring to the ability to utilize AI tools for instructional purposes; and (3) ethical awareness, which addresses responsible and critical use of AI in educational contexts.

Second, Digital Teaching Practice (DTP) was measured using six items adapted from Chiu (2024) and Ouyang and Jiao (2021). This construct reflects teachers' actual use of digital and AI tools in instructional settings, encompassing three dimensions: (1) instructional design using AI, (2) classroom implementation, and (3) assessment and feedback practices.

Third, Institutional Support (IS) was assessed using six items adapted from Scherer et al. (2021) and Simatupang et al. (2025). This construct includes three dimensions: (1) infrastructure availability, (2) policy and incentive support, and (3) access to technical assistance and professional training.

Finally, Teaching Competency (TC) was measured using six items based on the OECD (2021) framework. This construct captures teachers' effectiveness in digital teaching environments across three dimensions: (1) instructional effectiveness, (2) student engagement, and (3) digital adaptability.

Pilot Testing and Validity. Before the main data collection, a pilot study was conducted with 30 vocational teachers to evaluate the clarity, reliability, and content validity of the instrument. Based on participant feedback, minor revisions were made to improve item wording and ensure contextual relevance.

Content validity was further established through expert review by three specialists in educational technology and curriculum development, who evaluated the alignment between items and their respective constructs. Internal consistency reliability was assessed using Cronbach's alpha, with all constructs exceeding the recommended threshold of 0.70, indicating acceptable reliability (Hair et al., 2019).

Data were collected via an online questionnaire distributed through institutional communication channels across participating vocational colleges. Participation was voluntary, and respondents were informed about the purpose of the study before completing the survey. To ensure data quality, only fully completed responses were included in the final analysis.

Data analysis was conducted using SPSS. The analytical procedure consisted of four stages. First, descriptive statistics, including mean and standard deviation, were calculated to examine the general distribution of the variables. Second, reliability analysis was performed using Cronbach's alpha and corrected item-total correlation (CITC) to assess internal consistency. Third, Pearson correlation analysis was conducted to examine the relationships among variables.

Finally, multiple linear regression analysis was employed to determine the predictive effects of Teacher AI Literacy, Digital Teaching Practice, and Institutional Support on Teaching Competency.

Justification of Statistical Techniques, multiple linear regression analysis was selected as the primary analytical method because the study aims to examine the simultaneous effects of multiple independent variables (TAL, DTP and IS) on a single dependent variable (TC). This approach allows for the comparison of the relative strength of each predictor.

Before conducting regression analysis, key statistical assumptions were tested to ensure the validity of the model. Normality was assessed using normal probability (P-P) plots, while homoscedasticity was examined through scatterplot analysis of residuals. Multicollinearity was evaluated using the Variance Inflation Factor (VIF)

values, with all values below the threshold of 5, indicating no multicollinearity issues. Independence of errors was confirmed using the Durbin-Watson statistic. The level of statistical significance was set at $p < 0.05$.

RESULTS

Interestingly, the proportion of institutions in the collected sample (185 teachers, or 61.1%, from Provincial High-level Schools and 118 teachers, or 38.9%, from Other Regular/Private Colleges) was almost identical to the actual population proportion (61.2 and 38.8%, respectively). This good match in terms of population demographics assures the representativeness of the sample. Table 1 describes the demographic characteristics of the participants.

Table 1. Demographic profile of vocational EFL teachers ($n = 303$).

Demographic factor	Frequency (f)	Percentage (%)
Teaching experience		
3 years and below	60	19.8
4–10 years	107	35.4
11–20 years	112	36.8
21 years and above	24	8
Educational level		
Bachelor's	30	9.9
Master's	251	83
PhD	22	7.1
Institutional category		
Provincial High-level Schools	185	61.1
Other Regular/Private Colleges	118	38.9

Measurement model: Descriptive statistics, reliability and validity

Obviously, as shown in Table 1, the basic information of 303 research participants indicates that the teaching staff of vocational colleges in Nanning are of high quality and very active in the use of digital applications. That is, 83.0% of the teachers are masters, and 70.7% of them use artificial intelligence tools at least once a week.

To evaluate internal consistency and the current status of the variables, descriptive statistics (Mean and S.D.) and Cronbach's Alpha were computed, as consolidated in Table 2.

The results indicate that all constructs demonstrate strong internal consistency across the critical

measurement framework. Moreover, the important reliability evidence may well suggest that Cronbach's alpha values ranging from 0.782 to 0.847, alongside an overall scale reliability of 0.892, could plausibly provide significant empirical support for the observed measurement validity. Given that the Corrected Item-Total Correlation (CITC) values might indicate that item cohesion was consistently high, the key results may suggest that internal structure remained stable across the scale. However, findings may show Teaching Competency had the highest average score ($M = 4.19$). Thus, results could reveal Institutional Support (IS, $M = 4.01$), Digital Teaching Practice (DTP, $M = 3.82$), and Teacher AI Literacy (TAL, $M = 3.63$), followed in descending order.

Table 2. Descriptive statistics and reliability of measurement items ($n = 303$).

Construct & Items	Mean (<i>M</i>)	S.D.	CITC	Cronbach's α
Teacher AI Literacy (TAL)	3.63	0.81	-	0.847
A1. Understand AI functions/logic	3.68	0.76	0.628	
A2. Recognize AI potential	3.67	0.87	0.633	
A3. Write effective prompts	3.63	0.77	0.594	
A4. Generate customized resources	3.59	0.84	0.584	
A5. Assess AI content accuracy	3.66	0.81	0.595	
A6. Judge if the materials match the levels	3.63	0.84	0.565	
A7. Aware of data privacy/ethics	3.49	0.79	0.474	
A8. Guide students on ethical AI use	3.71	0.81	0.619	
Digital Teaching Practice (DTP)	3.82	0.79	-	0.809
B9. Prepare lesson plans/PPTs	3.89	0.76	0.618	
B10. Structure/organize course content	3.82	0.81	0.609	
B11. Use translation/grammar tools	3.83	0.83	0.619	
B12. Assign AI tasks to students	3.73	0.81	0.515	
B13. Use automated grading	3.8	0.72	0.521	
B14. Track learning progress	3.82	0.83	0.541	
Institutional Support (IS)	4.01	0.85	-	0.782
C15. Admin actively encourages	4.12	0.82	0.578	
C16. Clear policies/incentives	3.98	0.85	0.467	
C17. Stable internet/hardware	4.05	0.79	0.574	
C18. Access to paid AI software	4.1	0.81	0.542	
C19. Regular professional training	3.95	0.88	0.497	
C20. Timely tech staff support	3.88	0.92	0.534	
Teaching Competency (TC)	4.19	0.78	-	0.824
D21. Lesson prep efficiency improves	4.25	0.75	0.544	
D22. Achieve language skill objectives	4.18	0.78	0.551	
D23. Confident in digital challenges	4.2	0.76	0.537	
D24. Students respond more actively	4.15	0.8	0.543	
D25. Incorporate AI without disruption	4.12	0.82	0.524	
D26. Overall teaching quality improves	4.22	0.77	0.587	
Overall Scale Reliability				0.892

Note: Corrected Item–Total Correlation (CITC) values greater than 0.30 indicate acceptable item discrimination, while values above 0.50 are considered strong. Cronbach's alpha (α) values of 0.70 or higher indicate acceptable internal consistency, 0.80 or higher indicate good reliability, and 0.90 or higher indicate excellent reliability (Hair et al., 2019; DeVellis, 2017).

Table 3. Pearson correlation matrix of research variables ($n = 303$).

Variables	TAL	DTP	IS	TC
Teacher AI Literacy (TAL)	1			
Digital Teaching Practice (DTP)	0.542**	1		
Institutional Support (IS)	0.384**	0.421**	1	
Teaching Competency (TC)	0.518**	0.605**	0.457**	1

Note: ** $p < 0.01$.

Correlation analysis

Pearson correlation analysis was run to determine the bivariate relationships between the constructs prior to running regression modeling.

From Table 3, all variables are significantly positively correlated. Particularly, Digital Teaching Practice and Teaching Competency have the highest correlation ($r = 0.605$, $p < 0.01$), that is, actual teaching is significantly related to professional competency.

Multiple linear regression analysis

To explore the predictive effect of TAL, DTP and IS on Teaching Competency, we used the method of multiple linear regression analysis. Before we interpret the regression coefficients, we should test some statistical assumptions.

The Durbin-Watson statistic was 1.842, suggesting that there was no apparent autocorrelation among these

residuals. In addition, the variance inflation factor (VIF) values were 1.254 to 1.425, indicating that there was no apparent multicollinearity among independent variables. Finally, we used the scatter plot and normal P-P plot to verify that the residuals fulfilled the assumptions of homoscedasticity and normality.

Table 4 shows that the model's R^2 value was 0.512 ($F = 72.685$, $p < 0.001$). This means three independent variables summarized 51.2% of the variance of teaching ability.

According to the standardized coefficients (β), the significance of each predictor variables were ranked as follows: DTP has greatest influence ($\beta = 0.438$, $t = 9.511$, $p < 0.01$), followed by TAL ($\beta = 0.245$, $t = 5.732$, $p < 0.01$), while IS shows least influence ($\beta = 0.201$, $t = 4.868$, $p < 0.01$).

The assumptions of regression were satisfied. The Durbin-Watson value (1.842) indicates independence of errors. VIF values ranged from 1.254 to 1.425, indicating no multicollinearity. Visual inspection of scatterplots and P-P plots confirmed homoscedasticity and normality.

Table 4. Multiple regression analysis of Teaching Competency ($n = 303$).

Variables	Unstandardized B	Std. Error	Standardized β	t	p	VIF
(Constant)	0.385	0.052	-	7.404	0.000**	-
TAL	0.245	0.041	0.245	5.732	0.000**	1.425
DTP	0.438	0.045	0.438	9.511	0.000**	1.386
IS	0.201	0.038	0.201	4.868	0.000**	1.254

Note: Dependent variable = TC. $R^2 = 0.512$; Adjusted $R^2 = 0.505$; $F(3, 299) = 72.685$, $p < 0.001$. ** $p < 0.01$.
VIF = Variance Inflation Factor; values below 10 indicate no serious multicollinearity.

The results indicate that all constructs demonstrate acceptable internal consistency, with Cronbach's alpha values ranging from 0.782 to 0.847 (Table 2A). Descriptive statistics (Table 2) show that Teaching Competency reported the highest mean score, followed by Institutional Support, Digital Teaching Practice, and Teacher AI Literacy.

Pearson correlation analysis (Table 3) reveals that all variables are positively and significantly correlated. Digital Teaching Practice shows the strongest correlation with Teaching Competency ($r = 0.605$, $p < 0.01$).

Multiple regression analysis (Table 4) indicates that the model explains 51.2% of the variance in Teaching Competency ($R^2 = 0.512$, $F(3, 299) = 72.685$, $p < 0.001$). Digital Teaching Practice is the strongest predictor ($\beta = 0.438$), followed by Teacher AI Literacy ($\beta = 0.245$) and Institutional Support ($\beta = 0.201$).

The R^2 value of 0.512 indicates a moderate-to-strong explanatory power of the model, suggesting that the selected predictors substantially explain variations in teaching competency.

Hypotheses testing results

Based on the empirical findings, all three hypotheses have been statistically validated.

The results summarized in Table 5 could indicate that a significant structural relationship may well emerge within the digital pedagogical environment, suggesting that these critical empirical findings demonstrate substantial theoretical implications for understanding teacher competency development. Moreover, the important evidence may suggest that H2 (Digital Teaching Practice) emerged as the primary driver of competency, significantly outweighing H1 (Teacher AI Literacy) and H3 (Institutional Support). Thus, findings might confirm enhancement of English teachers' competency relies on a complex interplay of personal factors. However, evidence may show behavioral and environmental factors affect professional development. In light of the results, collective data could indicate that active classroom implementation acts as the most critical catalyst for translating cognitive readiness into actual mastery.

Table 5. Summary of hypotheses testing results ($n = 303$).

Hypotheses	Relationship path	Beta (β)	p-value	Result
H1	Teacher AI Literacy (TAL) → TC	0.245	0.000**	Accepted
H2	Digital Teaching Practice (DTP) → TC	0.438	0.000**	Accepted
H3	Institutional Support (IS) → TC	0.201	0.000**	Accepted

Note: ** $p < 0.01$.

DISCUSSION

This study uses Social Cognitive Theory to compare the impacts of Teacher AI Literacy (TAL), Digital Teaching Practice (DTP), and Institutional Support (IS) on teaching competency. These characteristics explain 51.2% of teaching competency variance, with Digital Teaching Practice being the greatest predictor. This shows that behavioral engagement is crucial to turning technical potential into successful education. The findings illuminate SCT use in AI-integrated education theoretically. SCT states that personal, behavioral, and environmental factors affect performance (Bandura, 1986), but this study shows that behavioral factors dominate.

Teacher AI Literacy is a cognitive prerequisite for teaching competency. The findings support previous research indicating TAL has a considerable favorable effect (Ng et al., 2023; Wang, 2023). However, the moderate impact size ($\beta = 0.245$) suggests that cognitive preparedness alone does not drive performance. This confirms a basic literary tension: teachers with AI understanding may not practice effectively. Cognitive competency requires behavioral involvement.

Second, Digital Teaching Practice drives teaching competency most. DTP has the largest predictive effect ($\beta = 0.438$), indicating that classroom implementation is the key factor affecting professional success. This conclusion supports Chiu's (2024) "Adaptive Orchestration," showing that continual AI tool use improves educational adaptability and efficacy. It also supports the SCT idea that knowledge and environment affect outcomes through behavior. Teachers' actions, not their knowledge or resources, determine teaching competency in this context.

Third, Institutional Support enables indirectly. While IS has the greatest mean score, it is the weakest predictor among the three variables, despite a considerable positive effect ($\beta = 0.201$). This shows a "support–usage gap," where institutional resources and policies are available but not completely implemented in instruction. This supports previous findings that technology infrastructure alone does not improve performance (Zawacki-Richter et al., 2024). Instead, environmental support fosters development but requires teachers' participation to yield substantial results.

These findings extend Social Cognitive Theory by showing a hierarchical link between its major components.

In particular, behavioral factors (DTP) have the greatest impact, followed by personal factors (TAL) and environmental variables (IS). This study shows that behavioral enactment is the main mechanism linking cognition and environment to performance in AI-integrated educational situations.

While the findings confirm prior studies emphasizing the role of digital practice (Chiu, 2024), they contrast with research suggesting that institutional support plays a more direct role in competency development (Scherer et al., 2021). This discrepancy may be explained by contextual differences, where resource availability does not guarantee effective utilization in vocational education settings.

This study extends Social Cognitive Theory by empirically demonstrating that behavioral engagement is not only a mediating factor but the dominant mechanism through which cognitive and environmental factors influence teaching competency in AI-integrated education.

RECOMMENDATION

Based on the significant empirical results of this study, strategic recommendations could indicate that education administrators and policymakers may reasonably consider these critical findings to enhance teaching capabilities in vocational education in the era of artificial intelligence.

Moreover, given that digital teaching practice (DTP) appears to be the primary driver of competence ($\beta = 0.438$), the important evidence may suggest that vocational schools shift their focus in teacher development from "theoretical knowledge acquisition" to "practical teaching enactment." The average DTP score of 3.82 might indicate that teachers are willing to use AI tools, but the significant evidence could demonstrate that a gap exists between basic mastery and advanced application. Thus, administrators may show awareness of this gap. Therefore, findings could support organizing "sandbox workshops" to promote collaborative curriculum design and student assessment standards that integrate AI, with a focus on practical application to develop behavioral components for teacher professional development.

Descriptive analysis also indicated that the average score of educators' score on ethical issues of data privacy

and plagiarism (question A7) was the lowest (3.49), which unveiled obvious hidden risks of digitalization, consequently, it is recommended that vocational education institutions establish a corresponding "AI governance scheme" for vocational education, which would provide clear guidelines for the use of generative AI and ensure academic integrity, to support teachers to use AI with confidence and ethics.

Institutional Support (IS) may well demonstrate that the significant empirical tension between its highest overall mean score (4.01) and its weakest predictive power among all variables ($\beta = 0.201$) could plausibly indicate a critical theoretical misalignment in how these critical infrastructural resources currently function. Given that this important evidence suggests a pattern, the findings might indicate that hardware and policy support appear to operate merely as hygiene factors rather than as meaningful drivers of adoption. However, results may suggest this reflects the well-documented IT Productivity Paradox. Thus, administrators may need to shift focus toward targeted technical assistance. Therefore, findings could show that general resource provision falls short of practical need.

Limitations

This study is subject to several limitations. First, the cross-sectional design restricts the ability to infer causal relationships among variables. Second, the data were collected from a single region (Guangxi, China), which may limit generalizability to other contexts. Third, self-reported measures may introduce response bias. Future research should adopt longitudinal designs, multi-region sampling, and mixed-method approaches to validate and extend the findings.

RESEARCH CONTRIBUTION

This study makes a solid contribution to the digital transformation of vocational education from multiple dimensions. Theoretically, empirical evidence confirms that behavioral practices (digital teaching practices) are significantly superior to environmental resources (institutional support), advancing the development of Social Cognition Theory (SCT) and providing a data explanation for the "IT productivity paradox"—institutional hardware and policies need to be integrated into teachers' teaching behaviors to be effective; by quantifying structural impacts, it improves the application of SCT in the context of vocational English education integrated with artificial intelligence.

This study provides the following practical implications from the following four levels: At the school level, this study can assist English teachers in realizing that students

should focus not only on the mastery of theoretical knowledge of artificial intelligence but also on its practical application and ethical awareness; at the organizational level, this study can assist university administrators in transitioning from an "infrastructure first" procurement model to a practice-oriented governance (e.g., sandbox workshop construction); at the industry level, this study can assist educational technology developers in abandoning generic platform development and constructing targeted teaching tools that can be directly applied in vocational English teaching scenarios (e.g., targeted prompt library development); and at the policy-making level, this study can assist the government in western China in taking actual teaching application rates, rather than simply hardware investment, as the basis for assessing the efficiency of institutional funding to ensure the sustained and healthy development of vocational education in western China, thereby supporting the UN Sustainable Development Goal 4 (Quality Education).

FURTHER RESEARCH

This study stresses the importance of digital teaching for the age of artificial intelligence; however, the cross-sectional feature of current data prevents us from observing the long-term development of teaching quality. In the future, we should use a longitudinal tracking design to investigate the long-term development of professional English teachers using AI tools for teaching in consecutive semesters; we can broaden the geographic scope of this study from Guangxi to eastern coastal provinces to obtain comparative information and verify the regional validity of the research results.

In addition to the current research's quantitative explanations, future studies are suggested to adopt qualitative methods, including in-depth interviews and classroom observations, and use a hybrid approach design to verify quantitative models and detect fine-grained psychological barriers existing in teachers' digital transformation. In addition, the effects of different types of AI tools, including generative texts and automated assessments, on teaching competence should be examined for more fine-grained implications for professional teacher development.

In this study, we clarified the relative predictive power of several relevant factors through multiple regression analysis. However, the important empirical evidence could indicate that structural equation modeling may well explore whether digital teaching practices might reasonably play a mediating role in the triadic structure of social cognition theory. Moreover, through this critical research method, we might demonstrate that we gain a clearer and deeper understanding of the dynamic relationship between cognitive readiness, environmental support, and behavioral implementation in the context of the integration

of artificial intelligence and vocational education. Thus, this evidence may suggest important implications for the sustainable development of regional vocational education. Additionally, findings could affect contributions to UN Sustainable Development Goal 4 (Quality Education).

CONCLUSION

This study demonstrates that Digital Teaching Practice is the most significant predictor of English teaching competency in the AI era, outperforming both Teacher AI Literacy and Institutional Support. While AI literacy provides a necessary cognitive foundation and institutional support offers enabling conditions, competency development is primarily driven by actual pedagogical implementation. The findings extend Social Cognitive Theory by confirming the dominant role of behavioral factors in technology-integrated education. They also provide empirical support for the “IT productivity paradox,” showing that technological investment alone does not guarantee improved performance. Practically, the study suggests that vocational institutions should shift from infrastructure-focused strategies to practice-oriented professional development, emphasizing hands-on training, teaching innovation, and classroom integration of AI tools.

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