INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN PROGRESSIVE EDUCATION & DEVELOPMENT

OPEN ACCESS JOURNAL

Vol 15, Issue 1, (2026) E-ISSN: 2226-6348

AI Educational Platforms and Digital Technology Skills in Vocational Education: An Empirical Study

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DOI Link: http://dx.doi.org/10.6007/IJARPED/v15-i1/27375

Published Online: 06 January 2026

Abstract

Artificial intelligence (AI) is profoundly reshaping education, particularly vocational education and training (VET) which bridges education and industry. Vocational colleges face the imperative to modernize teaching to cultivate workforce-ready graduates with solid digital skills. This study focuses on the "Fundamentals of Digital Technology Application" course at Chongqing Public Transport Vocational College, adopting a blended learning mode to explore the relationship between platform participation indicators (video viewing, forum interaction, quiz scores) and students' digital technology skills, as well as the effectiveness of AI platform functions in facilitating understanding of IoT, big data, and AI. Employing a mixed-methods approach integrating quantitative platform data, surveys, and interviews, the study finds that increased participation in video tutorials and quizzes significantly improves practical task performance—quiz completion rate has a prediction coefficient β=0.41 for final grades, and video viewing duration β=0.32, together explaining 58% of score variation. Personalized feedback and gamified quizzes boost learning motivation and knowledge retention. However, unstable network connections, disparities in digital literacy, motivational issues, and inadequate feedback mechanisms hinder learning. This study provides evidence-based perspectives on AI platforms' role in VET, emphasizing adaptive teaching design and teacher training. It proposes prioritizing platform accessibility, integrating industry-related projects, and adopting blended learning to support diverse learners in a rapidly evolving technological landscape.

Keywords: AI in Education (AIEd), Vocational Education and Training (VET), Digital Technology Skills, Blended Learning, Platform Engagement

Introduction

Research Background

With the rapid advancement of digital technology, AI tools have become pivotal in professions and daily life, transforming education. AI in education acts as an advanced assistant that analyzes data, identifies patterns, and adapts to individual student needs (Shirshikov, 2025), with common applications including adaptive learning systems, generative AI tools, and predictive analytics.

For VET, cultivating high-quality technical professionals with solid digital backgrounds is crucial for meeting social development demands, as over 70% of new frontline workers in key industries in China are vocational school graduates (Hu, 2024). Digital technology enhances workers' employability and innovation capabilities, highlighting its core position in VET.

However, traditional vocational institutions face challenges such as outdated curricula, insufficient practical resources, and inadequate problem-solving training. AI-powered educational platforms offer personalized learning paths, industrial environment simulations, and instant assessments, enabling teachers to focus on high-value mentoring. Nevertheless, AI research in education has predominantly focused on higher education and K-12 settings, with findings not fully applicable to VET's competency-based learning, work-integrated experiences, and industry-specific tool mastery. There is an urgent need for empirical studies on AI platforms' function in the unique vocational ecosystem. This study takes the "Fundamentals of Digital Technology Application" course at Chongqing Public Transport Vocational College as the research case, adopting a blended learning mode (integrating online AI platform learning and offline classroom teaching) to explore the role of AI platforms in enhancing students' digital technology skills, addressing the aforementioned gap by providing an empirical analysis model for VET curriculum design.

Key Concepts Definition

- AI Educational Platform: A digital learning environment leveraging AI technologies (machine learning, natural language processing, data analytics) to deliver personalized learning experiences and teaching support, dynamically adjusting content and providing real-time feedback (Chen et al., 2020). Specifically, it refers to the online teaching platform for the "Fundamentals of Digital Technology Application" course at Chongqing Public Transport Vocational College.
- Platform Engagement: The level and quality of students' involvement with the AI platform, measured by quantifiable indicators such as login frequency, study duration, resource browsing volume, homework submission rate, and forum posts (Henrie, 2015).
- Blended Learning: A teaching mode integrating traditional face-to-face teaching with online learning and digital media, leveraging strengths of both approaches to improve effectiveness and efficiency (Graham, 2019). Specifically, it denotes the teaching mode adopted in the target course of this study, combining online platform learning with offline classroom teaching, which serves as the contextual foundation for exploring the relationship between AI educational platforms and digital technology skills.
- Digital Technology Skills: The ability to effectively and critically use digital tools, applications, and systems to access, manage, integrate, evaluate, create, and communicate information, encompassing technical proficiency and cognitive capabilities (European Commission, 2022). Operationalized as competencies measured through assignments and exams related to IoT, big data, and AI in a vocational context.

Research Objectives and Questions

Research Objectives

- RO1: Evaluate the effectiveness of AI educational platforms in enhancing students' digital technology skills at Chongqing Public Transport Vocational College.
- RO2: Explore the challenges faced in using AI educational platforms to improve students' digital technology skills at the college.

- RO3: Identify opportunities for AI educational platforms to enhance students' digital technology skills at the college.

Research Questions

- RQ1: How effective are AI educational platforms in improving students' digital technology skills at Chongqing Public Transport Vocational College?
- RQ2: What are the main challenges encountered by students and teachers when using AI educational platforms to enhance digital technology skills?
- RQ3: What opportunities exist for AI educational platforms to enhance digital technology skills among students?

Scope and Limitations

This study is a case study focusing on the "Fundamentals of Digital Technology Application" course in the School of Intelligent Transportation at Chongqing Public Transport Vocational College. The primary research subjects are students enrolled in this course, with platform participation indicators, performance data, and survey feedback forming the core of quantitative and qualitative analyses. Teachers were interviewed to provide teaching context, but the research design prioritizes student experiences.

Employing a mixed-methods approach, the study draws data from platform analytics, questionnaires, and interviews, each with inherent limitations. Platform analytics provides objective data but may not capture learning quality or off-platform activities. Student surveys are subject to social desirability bias, and interviews reflect subjective experiences of a small number of participants. The findings are embedded within the specific course and institutional context, so their transferability to other vocational colleges may be limited by resource or teaching culture differences.

Significance of the Study

Theoretical Significance

This study contributes to AI applications research in VET. There remains a significant gap in empirical studies of specific AI tools in skills-based training environments (Chen, 2022). Through in-depth analysis of AI platform applications in a digital technology foundational course, this study provides empirical cases and theoretical support, deepening understanding of the mechanism by which AI platforms enhance vocational students' skills and contributing to a more comprehensive VET theoretical system (UNESCO, 2023).

Practical Significance

The study offers references for optimizing digital technology courses at Chongqing Public Transport Vocational College and other vocational institutions. It provides specific recommendations for the college to optimize teaching design, platform functions, and teaching strategies of the target course. Simultaneously, the research experiences and conclusions offer valuable insights for other vocational colleges adopting similar teaching models, helping them better leverage AI platforms. By analyzing problems and needs raised by students and teachers, the study provides valuable feedback for AI platform developers.

Literature Review

Theoretical Foundations

The study is supported by a theoretical framework integrating three complementary models to comprehensively explore AI platform applications in VET.

Technology Acceptance Model (TAM)

Proposed by Fred Davis in 1989, TAM explains and predicts end-user adoption of information systems. Its core premise is that users' behavioral intentions to use technology depend on perceived usefulness (the degree to which a system enhances performance) and perceived ease of use (the degree to which a system is free of physical and mental effort) (Davis, 1989, p. 323). TAM has proven applicable in various learning environments (Al-Emran et al., 2020), helping address whether vocational students will adopt and accept AI platforms by exploring engagement motivations.

Constructivist Learning Theory

Rooted in Piaget (1952) and Vygotsky (1978), constructivist learning theory posits that learning is an interactive process where learners construct new knowledge through experiences and environmental interactions. Unlike behaviorism, it emphasizes active connection of new information with existing cognitive structures (Bandura, 1977). Constructivist principles are reflected in modern AI platforms through scaffolded learning, collaborative knowledge construction, and authentic problem-solving environments, with proven effectiveness in online learning (Means et al., 2013).

Social Cognitive Theory (SCT)

Developed by Albert Bandura in 1986, SCT emphasizes triadic reciprocity among behavioral, personal, and environmental factors in learning. Key constructs include observational learning, self-efficacy, and self-regulation (Bandura, 1997). In AI educational environments, SCT offers insights into how students develop digital skills, with high self-efficacy fostering better learning outcomes, a quality that can be nurtured through well-designed platform functions.

Theoretical Framework Integration

This study's theoretical framework integrates TAM, SCT, and Constructivist Learning Theory. TAM explains whether and why students use AI platforms. SCT describes how psychological factors influence their learning process in blended activities. Constructivist Theory illustrates how AI platform teaching methods facilitate practical knowledge construction. Together, they provide a comprehensive perspective for exploring AI platform applications in VET.

Systematic Review of Previous Research

Research on Digital Technology Skills in VET

Over the past 30 years, research on digital skills in VET has evolved from basic computer knowledge in the 1990s to complex competencies including digital problem-solving and data literacy after the introduction of "Industry 4.0" (Pfeiffer, 2015). Recent research (2020-present) focuses on emerging technologies such as AI, IoT, and big data analytics (Xu & Ouyang, 2022).

Research on AI Educational Platform Applications in VET

Current research focuses on AI platforms optimizing technical skill acquisition through personalized learning paths and simulated work environments (Chen et al., 2023; Lakshmi et al., 2023). However, gaps remain, including lack of longitudinal studies on skill transfer to professional contexts, limited attention to teacher integration, uneven regional development, and equity issues. Methodological limitations include small sample sizes and over-reliance on self-reported data (Xu & Ouyang, 2022).

Study Positioning: Filling Gaps

This study addresses three critical gaps: contextual gaps by focusing on a Chinese VET context; methodological gaps through mixed-methods design; and application gaps by specifically examining digital technology skills. It adopts a general-to-specific approach, translating theoretical potential into practical evidence through a case study of Chongqing Public Transport Vocational College.

Methodology

Research Design

The study employs an explanatory sequential mixed-methods design (Creswell & Plano Clark, 2017) and a single case study design (Yin, 2018). This study adopts an explanatory sequential mixed-methods design, taking the blended learning mode of the "Fundamentals of Digital Technology Application" course as the research context. This design is suitable for achieving research objectives as it quantitatively evaluates platform effectiveness and explores underlying factors influencing results. The research process includes three phases: quantitative (collecting and analyzing platform data and survey responses to address RQ1), qualitative (conducting semi-structured interviews to explore challenges for RQ2), and integration (merging findings to generate optimization recommendations for RQ3).

Population and Sampling

- Research Population: All AI-major students in the School of Intelligent Transportation at Chongqing Public Transport Vocational College for the 2024-2025 academic year, and all instructors teaching the "Fundamentals of Digital Technology Application" course.
- Sampling Strategy and Sample Size: Purposive sampling is used to select cases with rich information (Palinkas et al., 2015). The student sample includes entire classes enrolled in the course. For the quantitative phase, 98 valid responses were collected out of 110 (response rate 89%). For the qualitative phase, a subset of students and all 4 instructors were invited to participate in interviews.

Research Instruments

- Platform Data: Exported from the course's online platform, including login frequency, video viewing duration, forum posts, assignment submission status and grades, test scores, and usage of specific features.
- Structured Questionnaire: Consists of demographic information, standardized scales measuring TAM constructs and self-efficacy, and open-ended questions for qualitative insights.
- Semi-Structured Teacher Interview Protocol: Key areas include platform integration into teaching strategies, student engagement observations, blended learning challenges, and improvement recommendations.

Data Collection Procedures

- Platform Data Collection: Exported through the platform's backend management system, covering the entire semester, with attention to completeness and accuracy.
- Student Questionnaire Survey: Distributed and collected via online platforms, with students informed of study purpose and data confidentiality. Data is sorted and cleaned after collection.
- Teacher Interviews: Conducted in semi-structured format, lasting 40-60 minutes, either face-to-face or via online video conferencing, with the process recorded with consent.

Data Analysis

Quantitative Analysis

- Descriptive Statistics: Calculate login times, video viewing duration, assignment completion rates, and average exam scores to understand overall engagement and performance.
- Inferential Statistics: Use Pearson correlation coefficient to analyze relationships between platform engagement indicators and digital technology skills performance. Use regression analysis to identify significant predictors of skills performance. Data analysis is performed using SPSS.

Qualitative Analysis

- Thematic Analysis: Identify patterns in open-ended questionnaire responses and interview records to determine key challenges, platform function evaluations, and improvement suggestions.
- Content Analysis: Analyze student forum posts to reveal interaction patterns, knowledge understanding, and learning challenges.

Ethical Considerations and Validity/Reliability

- Ethical Considerations: Maintain strict confidentiality of personal information, process and present data anonymously. Obtain written informed consent from participants. Properly store collected data to prevent leakage or misuse.
- Validity and Reliability: Demonstrate strong validity through multiple methods. Achieve reliability through measurement and process reliability, with platform-exported data considered reliable due to objectivity and traceability. For the questionnaire, reliability and validity are enhanced through Cronbach's Alpha Coefficient testing ($\alpha = 0.82$, indicating good internal consistency), content validity checks, and construct validity analysis.

Results

Participant Demographic Profile

Study participants include 98 students and 4 instructors. The student group is predominantly young (84.7% aged 18-21) and male (63.3%), with over half (53.1%) reporting only basic digital literacy at enrollment, and 9.2% relying solely on smartphones to access courses.

Table 4.1
Demographic Characteristics of Student Participants (N=98)

Characteristic	Category	Frequency	Percentage
Gender	Male	62	63.3%
	Female	36	36.7%
Age	18-19 years	45	45.9%
	20-21 years	38	38.8%
	22 years and above	15	15.3%
Digital Literacy	Basic	52	53.1%
	Intermediate	34	34.7%
	Advanced	12	12.2%
Digital Device	Personal Laptop	71	72.4%
	College Computer Lab	18	18.4%
	Smart Phone Only	9	9.2%

Presentation of Findings

RQ1: Quantitative Analysis of Platform Effectiveness and Skill Enhancement

(a) Descriptive Analysis of Platform Engagement

Students log in approximately 4 times per week, spending an average of 125.6 minutes weekly watching video tutorials. Forum participation is uneven (average 8.7 posts per semester), with quiz completion rate averaging 78.3% and assignment submission rate 85.2%.

Table 4.2
Descriptive Statistics of Platform Engagement Metrics

Engagement Metric	Mean	Standard Deviation	Minimum	Maximum
Weekly Login Frequency	4.2	1.8	1	12
Video Viewing Duration (min/week)	125.6	45.2	20	285
Forum Posts (per semester)	8.7	5.2	0	25
Quiz Completion Rate (%)	78.3	18.6	25	100
Assignment Submission Rate (%)	85.2	14.1	40	100

(b) Correlation between Engagement Metrics and Performance Outcomes

Pearson correlation analysis reveals significant positive correlations between all platform engagement indicators and academic performance. Quiz completion rate exhibits the strongest correlation with final exam scores ($r = .63$, $p < .01$), followed by video viewing duration ($r = .51$, $p < .01$). Practical assignment scores show the strongest overall correlation

with final exam scores (r = .72, p < .01). Forum participation shows the weakest correlations (r = .27-.34).

Table 4.3
Correlation Matrix of Engagement Metrics and Performance Outcomes

Variables	1	2	3	4	5	6
1. Video Viewing Duration	-	.42**	.56**	.47**	.45**	.51**
2. Forum Participation	.42**	-	.38**	.29**	.34**	.27**
3. Quiz Completion Rate	.56**	.38**	-	.62**	.58**	.63**
4. Assignment Submission Rate	.47**	.29**	.62**	-	.67**	.59**
5. Practical Assignment Score	.45**	.34**	.58**	.67**	-	.72**
6. Final Exam Score	.51**	.27**	.63**	.59**	.72**	-
Note: ** p < .01 (two-tailed)						

(c) Regression Analysis Predicting Final Exam Performance
A standard multiple regression shows the model is statistically significant ($F(4,93)=32.17$, $p < .001$), accounting for 58% of variance in final exam scores ($R^2 = .58$, Adjusted $R^2 = .56$). Quiz Completion Rate ($\beta = .41$, $p < .001$) and Video Viewing Duration ($\beta = .32$, $p = .001$) are the only significant predictors. Forum Participation ($\beta = 0.11$, $p = .190$) and Assignment Submission Rate ($\beta = 0.13$, $p = .120$) are non-significant.

Table 4.4
Multiple Regression Analysis Summary for Variables Predicting Final Exam Score

Predictor Variable	B	SEB	β	t	p
(Constant)	45.21	5.12	-	8.83	.000
Video Viewing Duration	0.18	0.05	.32	3.60	.001
Forum Participation	0.25	0.19	.11	1.32	.190
Quiz Completion Rate	0.65	0.11	.41	5.91	.000
Assignment Submission Rate	0.22	0.14	.13	1.57	.120
Note: Dependent Variable: Final Exam Score					

RQ2: Challenges Faced by Students and Teachers

Thematic analysis identifies four primary challenges:

1. Technical and Infrastructural Barriers: Unstable internet connectivity (especially in dormitories) and device limitations hinder consistent platform access. A student noted, "I often cannot stream the video tutorials smoothly in the evening when the network is congested, so I have to download them during off-peak hours." (Student Interview, ID: S01, Date: 2025-03-15) An instructor added, "Some interactive simulations require a computer with good processing power, which not all students have. They try to use their phones, but the experience is not the same." (Teacher Interview, ID: T01, Date: 2025-04-02)
2. Disparities in Digital Literacy: Significant differences in students' digital skills lead some to focus on technical navigation rather than course content. One lecturer mentioned, "I had to teach some students how to use the forum and submit their homework online in the first two weeks, so they were thrown away from the beginning." (Teacher Interview, ID: T02, Date: 2024-04-02) A student also shared, "I was confused by the platform's interface initially. It took me a while to find where the quizzes were located." (Student Interview, ID: S02, Date: 2024-03-16)
3. Motivational and Self-Regulation Challenges: The self-paced nature of online components leads to procrastination and superficial participation due to lack of direct supervision. As a lecturer stated, "When you are not in the physical classroom, it is easy to click on the video without really understanding it. Accountability is lower." (Teacher Interview, ID: T03, Date: 2024-04-03) A student admitted, "I tend to leave all the online quizzes until the day before the deadline. It becomes a rush, and I don't learn as much." (Student Interview, ID: S03, Date: 2024-03-16)

4. Inadequate Feedback and Support Mechanisms: Automated feedback is insufficient for complex tasks, and technical/academic support outside standard hours is difficult to access. A student said, "The platform told me that my test answer was wrong, but it didn't always explain it to me. For programming exercises, I need more feedback to know how to improve." (Student Interview, ID: S04, Date: 2024-03-17) A lecturer suggested, "We need a better system to help students in their spare time—maybe a simple AI chat robot to answer common questions, then upgrade to more difficult ones." (Teacher Interview, ID: T04, Date: 2024-04-03)

RQ3: Opportunities for AI Educational Platforms

Integrating quantitative and qualitative findings reveals five strategic optimization opportunities:

1. Enhanced Personalization & Adaptive Learning: AI-driven personalized learning paths adapting to performance levels, with NLP tools providing targeted support for complex assignments.
2. Universal Access & Streamlined User Experience: Mobile-first design enabling full platform functionality across devices, complemented by a mandatory digital literacy introductory module.
3. Proactive & Multi-Tiered Support Systems: 24/7 AI-driven chatbot for instant support, combined with a gamified peer-to-peer assistance forum.
4. Motivation & Engagement Design: Personalized time management tools, with intrinsic motivation enhanced through skill badges and industry-related challenge modules.
5. Industry-Aligned Authentic Assessment: Peer-collaborative simulations based on real-world problems and virtual internship projects reflecting transportation industry challenges.

Summary of Overall Findings

Content analysis of student forum posts shows 42% of posts relate to technical issues, 35% seek clarification on course concepts, 18% request assignment support, and 5% involve non-academic queries. Only 22% of help-seeking posts receive peer responses before instructor intervention, indicating limited collaborative problem-solving. "Urgent" posts receive 40% faster instructor responses but exhibit higher student frustration with delays.

Discussion

Discussion of Key Findings

This study demonstrates AI educational platforms significantly promote digital skill development in VET, with quiz completion ($\beta = 0.41$) and video participation ($\beta = 0.32$) as the strongest predictors of academic performance, aligning with constructivist learning principles.

Key implementation barriers include digital literacy disparities (53.1% at basic level), infrastructure limitations (9.2% relying on smartphones), and motivational challenges. These contextual factors substantially influence platform effectiveness, challenging assumptions of universal technology readiness.

The optimization framework prioritizing adaptive learning, mobile accessibility, and industry-aligned assessment represents progress beyond generic platform capabilities, addressing specific VET needs and resource constraints.

Comparison with Previous Studies

The positive correlation between platform participation (especially quiz completion and video viewing) and academic performance aligns with broader AI-driven digital learning research (Means et al., 2013). However, forum participation is not a significant predictor ($\beta = 0.11$, $p = 0.190$), explained by 42% of forum posts addressing technical issues rather than knowledge-focused discussions.

This study quantifies specific VET barriers: over half (53.1%) of students have basic digital literacy, and 9.2% rely solely on smartphones, transforming abstract theoretical challenges into measurable variables.

Theoretical and Practical Implications

Theoretical Implications

- Extension of TAM: Technology acceptance in VET is moderated by industry relevance and infrastructure constraints beyond perceived usefulness and ease of use.
- Advancement of Constructivist Learning Theory: Quantifies relative effectiveness of different participation types, highlighting structured scaffolding's importance in online learning for students with weak self-regulation.
- Contribution to VET Theory: Develops a framework for understanding technology integration in competency-based environments, identifying digital skill development challenges and opportunities.

Practical Implications

Chongqing Public Transport Vocational College should implement equipment borrowing programs, improve campus Wi-Fi, mandate digital literacy workshops, launch teacher training, develop a student support system, enhance the platform with Chinese interfaces and transportation-specific functions, and reallocate resources to digital infrastructure.

Other stakeholders: educational institutions must address infrastructure gaps and integrate digital literacy training; platform developers prioritize adaptive learning and mobile-first design; teachers balance online and offline activities; policymakers invest in technical infrastructure and develop quality standards; future researchers consider contextual adoption factors.

Conclusion and Future Research

Conclusion

Based on the blended learning practice of the "Fundamentals of Digital Technology Application" course, this study demonstrates AI educational platforms hold significant potential for enhancing VET students' digital technology skills, with quiz completion and video interaction as the most impactful activities. Specifically, quiz completion rate ($\beta = 0.41$) and video viewing duration ($\beta = 0.32$) together explain 58% of the variance in students' final exam scores, confirming that structured online learning activities effectively scaffold the development of digital technical competencies aligned with vocational needs. However, effectiveness is significantly influenced by contextual constraints including infrastructure disparities (e.g., 9.2% of students relying solely on smartphones for course access), digital

literacy differences (53.1% of students with only basic digital literacy at enrollment), and challenges in teaching integration such as inadequate feedback mechanisms and motivational regulation issues. The research provides verifiable empirical evidence and a comprehensive improvement framework that requires synergistic support from technical optimization, human resource development (e.g., student digital literacy training and teacher capacity building), and institutional policy adjustments. When AI platform design and implementation are tailored to address the unique characteristics of VET—such as competency-based learning objectives, work-integrated requirements, and industry-specific skill demands—they evolve from generic digital tools into targeted enablers for cultivating workforce-ready digital skills.

Beyond the practical implications and empirical findings outlined above, this study makes distinct theoretical and contextual contributions to advancing knowledge in AI education and vocational education. Theoretically, it makes three targeted contributions to existing knowledge: first, it extends the Technology Acceptance Model (TAM) by identifying industry relevance and infrastructure constraints as critical moderators—addressing the long-standing gap that TAM has rarely considered competency-based training and work-integrated needs in VET (Xu & Ouyang, 2022); second, it advances Constructivist Learning Theory by empirically validating that structured scaffolding (e.g., quizzes, video tutorials) is more effective than unguided interaction (e.g., open forums) for VET students with weak self-regulation—filling the gap that constructivist research has rarely quantified scaffolding effectiveness in skill-oriented contexts (Means et al., 2013); third, it supplements the VET theoretical system with a context-specific framework linking AI platform functions, student engagement, and digital skill outcomes, addressing the lack of empirical models for AI applications in VET's work-integrated and industry-oriented ecosystem. Contextually, the study addresses the underrepresentation of Chinese VET in existing research by providing empirical evidence from the intelligent transportation discipline, aligned with China's national digital transformation strategies. It quantifies context-specific constraints (53.1% of students with basic digital literacy, 9.2% relying solely on smartphones) and their impact on platform effectiveness, offering localized insights overlooked in Western-centric studies. These findings provide a replicable research template for developing countries or regions with uneven digital infrastructure, enriching the global knowledge base on AI in VET with non-Western, skill-oriented evidence. Collectively, these theoretical and contextual contributions address the three critical gaps identified in the literature—contextual, methodological, and application gaps—by translating theoretical potential into VET-specific empirical evidence that advances both AI education research and vocational education practice.

Recommendations for Future Research

Future research should:

1. Conduct longitudinal studies on long-term retention of digital skills and their transfer to workplace contexts. Given the core goal of VET is to prepare students for professional practice, tracking how AI platform-fostered digital skills translate into on-the-job performance and career development will further validate the practical value of such educational interventions.
2. Expand the research scope to multiple vocational colleges, including different disciplines (e.g., manufacturing, healthcare, information technology) and institutional types (public vs. private), to enhance the generalizability of research results and identify discipline-specific or institutional-specific patterns in AI platform application.
3. Explore the impact of teacher training programs on effective AI platform integration. As

teachers play a pivotal role in blending online and offline teaching, investigating how targeted training improves teachers' ability to design adaptive learning activities, address student digital literacy gaps, and optimize feedback mechanisms will provide actionable insights for institutional capacity building.

4. Investigate equity issues related to AI platform access and use. With 9.2% of students relying solely on smartphones and significant digital literacy disparities observed, future research should examine how to mitigate these inequities—e.g., through infrastructure improvement, device support programs, or differentiated platform design—and evaluate the impact of equity-focused interventions on learning outcomes.
5. Develop and validate context-specific assessment tools for measuring digital skill development in AI-enhanced VET. Current assessments often rely on traditional exam scores; future research should design competency-based assessment frameworks that capture both technical proficiency and cognitive capabilities (e.g., digital problem-solving, data analysis) in vocational-specific scenarios, aligning with the European Commission's definition of digital technology skills.

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