

Development Guidelines of Digital Literacy for Teachers in Guangxi Transportation Vocational and Technical College

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Abstract: This study investigates the current level of digital literacy among teachers at Guangxi Transportation Vocational and Technical College (GTVTC) and formulates corresponding development guidelines. In alignment with China's national policies on educational digitalization, such as the Education Informatization 2.0 Action Plan and the Teacher Digital Literacy industry standard, the research addresses the urgent need for vocational educators to integrate technology effectively into pedagogy. The study employs a mixed-methods approach, combining a questionnaire survey of teachers with structured interviews of key institutional informants. The findings reveal that teachers' digital literacy across five core dimensions—Technical Operational Skills, Information Search Skills, Digital Creativity Skills, Digital Social Responsibility Skills, and Digital Security Awareness Skills—is generally at a high level, though variations exist between dimensions. Based on the diagnostic results, this research proposes a set of structured, actionable development guidelines. These guidelines are designed to bridge the gap between national policy frameworks and institutional implementation, aiming to systematically enhance teachers' digital competence, foster innovative teaching practices, and ensure the ethical and secure use of technology, thereby supporting GTVTC's sustainable digital transformation.

Keywords: digital literacy, teacher development, vocational education, guidelines

1. Introduction

In the era of globalization and informatization, digital technology has become a core engine for social transformation, profoundly reshaping the educational ecosystem. The rapid development of new-generation intelligent technologies, such as artificial intelligence and big data, not only changes how knowledge is acquired and imparted but also drives education toward a networked, digital, and intelligent future. Within this context, teachers, as the primary agents of educational reform, possess a level of digital literacy that directly determines the depth and quality of technology-enabled education.

The Chinese government prioritizes the digitalization of education through top-level policy design. Key documents, including the Education Informatization 2.0 Action Plan (2018) and the Teacher Digital Literacy industry standard (2023), have established a comprehensive competency framework for teachers. These policies underscore digital literacy as a critical indicator for teachers' professional development and a strategic component in achieving educational modernization.

As a national pilot unit for digital campus construction and a model informatization institution in Guangxi, Guangxi Transportation Vocational and Technical College (GTVTC) has made preliminary progress

in digital resource development. However, high platform coverage and utilization rates do not equate to high levels of digital literacy. Current practices indicate that teachers' application of digital technologies often remains at the level of basic tool operation and resource acquisition, with significant gaps persisting in deep integration, innovative pedagogy, and systematic training in areas such as digital ethics and security. This situation mirrors the national challenge identified in policy documents: widespread basic competency but insufficient innovation capacity.

Therefore, this study aims to investigate the current level of digital literacy among teachers at GTVTC and to propose targeted development guidelines. The objectives are to diagnose existing competencies and gaps and to formulate actionable recommendations that align with institutional contexts, thereby enhancing teaching efficacy and ultimately contributing to the development of high-quality learners for society. This study establishes a policy-anchored framework centered on China's Teacher Digital Literacy Standard (2023), which synthesizes five core professional competencies—Technical Operational Skills, Information Search Skills, Digital Creativity Skills, Digital Social Responsibility Skills, and Digital Security Awareness Skills—as the foundation for developing the guidelines .

2. Rationale

The rationale for this study is anchored in the critical intersection of national policy mandates, institutional strategic needs, and the evolving demands of vocational education in the digital era. The impetus for developing specific guidelines for Guangxi Transportation Vocational and Technical College (GTVTC) stems from three compelling and interrelated reasons.

First, there is a pressing need to translate broad national policy frameworks into concrete, actionable plans at the institutional level. China's Education Informatization 2.0 Action Plan (2018) and the Teacher Digital Literacy industry standard (2023) provide a comprehensive vision and competency framework. However, these macro-level directives require contextualized interpretation and implementation pathways tailored to the unique ecosystem of vocational and technical colleges. GTVTC, as a pilot unit for digital campus construction, operates within the specific context of Guangxi's transportation industry and vocational education landscape. A generic application of national standards may not effectively address the college's particular challenges in integrating digital tools with practical, industry-aligned teaching. This study seeks to bridge this policy-implementation gap by developing guidelines that are both aligned with national mandates and finely tuned to GTVTC's operational realities and strategic goals.

Second, despite GTVTC's achievements in digital infrastructure and resource platform coverage, there exists a discernible discrepancy between tool utilization and profound pedagogical transformation. Preliminary observations and the national diagnosis of "insufficient innovation capacity" suggest that teachers' digital practices may be predominantly focused on basic operational tasks and resource acquisition. This potentially limits the move from a "tool-use" paradigm to an "ecosystem-reconstruction" paradigm, where technology fundamentally enhances learning design, personalized intervention, and cross-disciplinary innovation. Therefore, a systematic diagnosis of the current digital literacy level across its core dimensions—from technical operation to creativity and ethics—is essential. This diagnostic precision will uncover the specific strengths to build upon and the gaps to address, moving beyond assumptions to inform targeted capacity-building.

Third, the sustainable digital transformation of vocational education hinges on empowering teachers as the key change agents. Teachers' digital competence is not merely an individual skill set but a cornerstone of institutional teaching quality and innovation capacity. In the context of GTVTC, which cultivates talents for a rapidly digitizing transportation sector, teachers must be equipped not only to use digital tools but also to model

digital creativity, responsibility, and security for their students. Developing structured, evidence-based guidelines is a strategic investment in human capital. It provides a clear roadmap for professional development, resource allocation, and support mechanisms, ensuring that digital literacy development is systematic, equitable across different teacher demographics, and sustainable in the long term, thereby supporting the college's journey toward higher levels of digital maturity.

In summary, this study is rationalized by the necessity to operationalize national policy within a specific vocational college context, to address the gap between basic adoption and innovative integration of technology, and to establish a sustainable mechanism for teacher capacity development. The resulting guidelines aim to catalyze a more profound and effective digital transformation at GTVTC.

3. Title, Authors, Body Paragraphs, Sections Headings and References

3.1 Body paragraphs

This study establishes a policy-anchored framework centered on China's Teacher Digital Literacy Standard (2023), contextualized through Guangxi's Vocational Education Digitization Policy (2024) and GTVTC's institutional capacity-building priorities. The structure synthesizes five core professional competencies derived from an extensive literature synthesis as the foundational variables for investigation: Technical Operational Skills, Information Search Skills, Digital Creativity Skills, Digital Social Responsibility Skills, and Digital Security Awareness Skills. These variables directly inform the development of the targeted guidelines for GTVTC teachers.

To comprehensively assess the current level of teachers' digital literacy, the study employs a structured assessment tool based on these five key dimensions:

Technical Operational Skills: Measures teachers' proficiency in operating multimedia equipment, using office software and online teaching platforms, managing digital files, and adapting to new digital tools.

Information Search Skills: Evaluates teachers' ability to locate teaching resources using search engines and academic databases, critically evaluate information credibility, and organize retrieved materials systematically.

Digital Creativity Skills: Assesses teachers' capacity to create engaging digital teaching materials (e.g., videos, interactive resources), apply innovative digital teaching models (e.g., flipped classrooms), and share creative practices.

Digital Social Responsibility Skills: Examines teachers' adherence to copyright laws, protection of student data privacy, promotion of positive online interactions, and ethical use of technologies like AI.

Digital Security Awareness Skills: Evaluates teachers' practices regarding password security, phishing identification, data encryption, compliance with institutional security policies, and educating students on cybersecurity.

The purpose of the assessment is to diagnose the existing competencies and gaps within GTVTC's teaching faculty. This diagnostic data, combined with insights from key institutional informants, forms the empirical basis for formulating actionable, context-specific development guidelines aimed at systematically enhancing digital teaching competence.

3.1.1 Research Question(s)

1. What is the current level of digital literacy among teachers at Guangxi Transportation Vocational and Technical College across the five core dimensions?
2. What evidence-based guidelines can be developed to enhance the digital literacy of teachers at Guangxi Transportation Vocational and Technical College?

3.1.2 Objective(s)

1. To study the level of teachers' digital literacy in Guangxi Transportation Vocational and Technical College.
2. To provide development guidelines of digital literacy for teachers in Guangxi Transportation Vocational and Technical College.

3.2 Figures and Tables

3.2.1 The independent variables are the five core dimensions of digital literacy:

Technical Operational Skills, Information Search Skills, Digital Creativity Skills, Digital Social Responsibility Skills, and Digital Security Awareness Skills. The dependent variable is the overall digital literacy level of teachers, which the development guidelines aim to enhance.

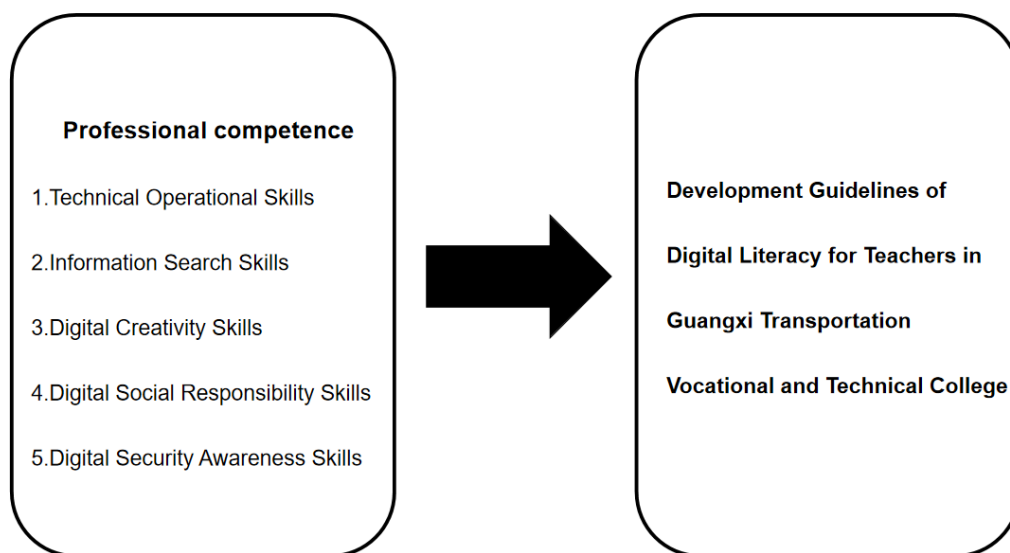


Figure 1.1 Research Framework

3.3 Tables

The table shows the frequency of each dimension across key literature, justifying the selection of the five core variables with frequencies ≥ 10 .

Table 1: The synthesis of digital literacy

Author / Characteristics of digital literacy	Technical Operational Skills	Information Search Skills	Digital Social Responsibility Skills	Digital Creativity Skills	Digital Security Awareness Skills	forthputting	Comprehension ability	Comprehension ability	Media Literacy	Digital Knowledge	Evaluation	Communication Literacy
Yi Tong & Luo Guofeng (2024)												
Luo Yunfang (2024)												
Dan Qiang (2023)												
Asgarov & Badalova (2024)												
Naruemol Poopinta (2022)												
Chenesa Sriwichai (2023)												
Nawaphat Kemkaman (2020)												
Tondeur et al. (2023)												
Thida Sae - all (2024)												

Table 2.1 The synthesis of digital literacy (Continue)

Author / Characteristics of digital literacy	Technical Operational Skills	Information Search Skills	Digital Social Responsibility Skills	Digital Creativity Skills	Digital Security Awareness Skills	forthputting	Comprehension ability	Comprehension ability	Media Literacy	Digital Knowledge	Evaluation	Communication Literacy
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Wu Xiaoyan (2023)												
Ng (2012)												
Calvani, Cartelli, Fini & Ranieri (2009)												
Eshet - Alkalai (2004)												
Martin (2005)												
Gilster (1997)												
Bawden (2008)												
Janssen et al. (2013)												
Hague & Payton (2010)												
Ilomäki, Paavola, Lakkala & Kantosalo (2016)												
Ferrari (2012)												

Table 2.1 The synthesis of digital literacy (Continue)

Author / Characteristics of digital literacy	Technical Operational Skills	Information Search Skills	Digital Social Responsibility Skills	Digital Creativity Skills	Digital Security Awareness Skills	forthputting	Comprehension ability	Comprehension ability	Media Literacy	Digital Knowledge	Evaluation	Communication Literacy
Ng (2015)												
Helsper & Eynon (2010)												
Lankshear & Knobel (2008)												
Livingstone(2004)												
Spante, Sofkova Hashemi, Lundin & Algers (2018)												
Hague (2011)												

Riel, Christian & Hinson (2012)												
Pangrazio (2016)												
Hatlevik & Christophersen (2013)												
Greene, Yu & Copeland (2014)												
Total	1	9	2	0	2							

Table 2: Descriptive Statistics of Teachers' Digital Literacy Level (Overall)

Digital literacy for teachers of Guangxi Transportation Vocational and Technical College	\bar{X}	SD.	Level	Ranking
Technical Operational Skills	3.75	0.78	high	5
Information search skills	3.79	0.73	high	4
Digital Creativity skills	3.98	0.68	high	2
Digital social responsibility skills	3.89	0.68	high	3
Digital Security Awareness skills	4.12	0.60	high	1
Total	3.91	0.49	high	

Table 3: Enhancement Guidelines for Digital Literacy (Excerpt: Technical Operational Skills)

Items	Issues of consideration / Opinions of interviewee
Technical Operational Skills	1 To enhance the Technical Operational Skills of teachers in Guangxi Transportation Vocational and Technical College.
	1.1 Strengthen systematic training on the operation of multimedia teaching equipment according to actual classroom needs.
	1.2 Provide regular workshops on the application of mainstream office software and online teaching platforms to improve practical proficiency.
	1.3 Improve teachers' ability to manage, store, and categorize digital teaching files efficiently across different platforms.
	1.4 Encourage teachers to learn and apply emerging digital tools and intelligent teaching aids in daily teaching practice.
	1.5 Establish continuous technical support and guidance mechanisms to ensure the effective integration of digital tools into teaching activities.
	2 To improve teachers' ability to manage and categorize digital files across computer and network storage.

Table 4.9 (Continued)

Items	Issues of consideration / Opinions of interviewee
2.1	Organize targeted training on file classification, cloud storage management, and cross-platform resource organization according to practical teaching needs.
2.2	Develop unified guidelines for digital file naming, storage structure, and backup procedures to standardize daily operation.
2.3	Establish practical workshops to strengthen teachers' competence in uploading, downloading, and managing teaching resources on institutional platforms.
2.4	Provide continuous technical support and peer mentoring mechanisms to improve operational proficiency in digital file management.

3.4 Sections Headings

3.5 Section Headings (from the Full Thesis Document):

- 1 Chapter 1: Introduction
- 2 Chapter 2: Literature Review
- 3 Chapter 3: Research Methodology
- 4 Chapter 4: Results of Analysis
- 5 Chapter 5: Conclusion, Discussion, and Recommendations
- 6 References
- 7 Appendix

4. Data Analysis

The data analysis will employ descriptive statistics, thematic analysis, and content analysis to examine the current level of digital literacy among teachers at Guangxi Transportation Vocational and Technical College (GTVTC) and to develop targeted enhancement guidelines.

First, descriptive statistics (mean, standard deviation, frequency) will be calculated for the questionnaire data to summarize the demographic characteristics of the respondents and their self-reported proficiency levels across the five core dimensions of digital literacy: Technical Operational Skills, Information Search Skills, Digital Creativity Skills, Digital Social Responsibility Skills, and Digital Security Awareness Skills. This will provide a quantitative overview of the current state.

Subsequently, qualitative data analysis will be conducted on the semi-structured interview transcripts. Thematic analysis will be employed to identify, analyze, and report patterns (themes) within the data regarding the specific challenges, needs, and suggestions related to each digital literacy dimension. This process will involve familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. The identified themes will directly inform the actionable items within the proposed guidelines.

To synthesize findings and formulate the guidelines, a structured content analysis will be performed. The insights from the descriptive statistics (identifying areas of lower mean scores) will be triangulated with the emergent themes from the interviews (identifying specific operational barriers and support requests). This

integrated analysis will ensure that the proposed guidelines are both evidence-based and contextually relevant, addressing the precise gaps and opportunities identified within GTVTC.

4.1 Descriptive Statistics

As shown in Table 2, the overall mean score for teachers' digital literacy was 3.91 $SD = 0.49$, indicating a generally "high" level of self-perceived competence. Among the five dimensions, Digital Security Awareness Skills received the highest mean score $M = 4.12, SD = 0.60$, ranking first. Digital Creativity Skills followed closely $M = 3.98, SD = 0.68$, ranking second. Digital Social Responsibility Skills $M = 3.89, SD = 0.68$ and Information Search Skills $M = 3.79, SD = 0.73$ ranked third and fourth, respectively. Technical Operational Skills had the lowest mean score among the five $M = 3.75, SD = 0.78$, though still within the "high" level category. The relatively moderate standard deviations across dimensions suggest a degree of consistency in responses, though some variability exists, particularly in Technical Operational Skills.

4.2 Thematic Analysis of Interview Data

The thematic analysis of interview transcripts revealed several key themes that informed the development of the enhancement guidelines. These themes were categorized according to the five digital literacy dimensions.

For Technical Operational Skills, a prominent theme was the "gap between awareness and fluent application." While teachers were familiar with basic tools, they expressed a need for systematic, hands-on training on advanced features of teaching platforms, multimedia equipment troubleshooting, and efficient digital resource management. Another theme was the "demand for just-in-time technical support" to resolve immediate classroom issues.

Regarding Information Search Skills, themes included "difficulty in efficiently locating high-quality, discipline-specific teaching resources" and "challenges in evaluating the credibility and relevance of online information." Teachers highlighted the need for training on advanced database search techniques and resource curation tools.

Concerning Digital Creativity Skills, a central theme was "time and resource constraints for material development." Teachers expressed interest in creating interactive content but felt limited by heavy workloads and a lack of user-friendly creation tools and templates. The theme of "desire for peer-sharing platforms" for innovative teaching methods also emerged strongly.

For Digital Social Responsibility Skills, themes centered on "uncertainty regarding copyright rules for mixed-media teaching materials" and "concerns about data privacy protocols when using third-party educational apps." Teachers acknowledged the importance of ethics but sought clearer institutional policies and guidelines.

Pertaining to Digital Security Awareness, while scores were high, the thematic analysis revealed a theme of "reactive rather than proactive practices." Teachers were aware of basic precautions like strong passwords but expressed less confidence in identifying sophisticated phishing attempts or understanding data encryption requirements for student information.

4.3 Synthesis for Guideline Development

The integrated analysis synthesizing descriptive statistics and interview themes provided a clear roadmap for guideline formulation. The quantitative data pinpointed Technical Operational Skills as the dimension with the lowest relative score, signaling it as a priority area for intervention. The qualitative themes then provided the specific, actionable content needed for this intervention, such as calls for systematic hardware/software training and better support systems.

Similarly, for dimensions with high scores like Digital Security Awareness, the thematic analysis added crucial nuance. It revealed that high self-perception might not fully translate into proactive, best-practice behaviors, justifying the inclusion of guidelines focused on advanced threat awareness and policy compliance, not just basic knowledge.

The guidelines were thus constructed by directly addressing the challenges and needs identified in the thematic analysis. Each proposed action under the five dimensions is a direct response to a specific theme extracted from the interview data, ensuring the guidelines are practical, teacher-informed, and targeted. For instance, the guideline "Provide regular workshops on the application of mainstream office software and online teaching platforms" directly addresses the theme "gap between awareness and fluent application" under Technical Operational Skills.

This combined analytical approach ensures that the final output—the set of digital literacy enhancement guidelines—is not a generic list but a tailored, evidence-based framework designed to elevate the specific competencies required by GTVTC teachers in their digital teaching environment.

5. Discussion, Conclusion and Recommendations

This research enhances the comprehension of digital literacy development within vocational education settings and provides tangible recommendations for educational administrators, teacher training institutes, and policy makers.

The research data demonstrates robust confirmation of the idea that while teachers at Guangxi Transportation Vocational and Technical College possess a strong foundation in digital safety and ethics, significant gaps remain in technical operational skills and digital creativity. The descriptive statistical results revealed a distinct disparity: Digital Security Awareness achieved the highest mean score, whereas Technical Operational Skills ranked the lowest among the five dimensions. The thematic analysis validated these quantitative findings, identifying a "gap between awareness and fluent application" where teachers understand the importance of digital tools but struggle with advanced operational execution and resource integration.

Previous research investigations have confirmed that the successful integration of technology in education depends not merely on access to hardware but on the continuous professional development of staff. The current findings align with the Technology Acceptance Model and adult learning theories, suggesting that perceived ease of use is a critical barrier. The interview themes highlighted that heavy workloads and a lack of systematic training hinder the transition from basic awareness to creative application. The strong performance in Digital Security Awareness suggests that institutional safety protocols are well-communicated; however, the lower scores in technical operations imply that future training must shift focus from theoretical knowledge to hands-on, practical skill acquisition.

The discovered research findings provide crucial benefits for vocational college administrators and curriculum developers. Educational leaders need to prioritize "just-in-time" technical support and establish peer-learning communities to address the operational bottlenecks identified in the thematic analysis. Integrating specific workshops on advanced software features and multimedia resource management into the regular professional development schedule will aid teachers in bridging the gap between digital awareness and creative teaching application.

Research findings also demonstrate that clear institutional policies are essential for fostering digital social responsibility. Since teachers expressed uncertainty regarding copyright and data privacy protocols, colleges should develop comprehensive, easy-to-understand guidelines on intellectual property and data usage. This will empower teachers to utilize digital resources confidently without fear of infringement or security breaches.

Furthermore, policy reviews require the integration of structured digital competency frameworks into teacher evaluation systems. Government agencies and educational boards need to support initiatives that provide sustainable funding for digital infrastructure and mandate periodic, skills-based digital literacy assessments to ensure continuous improvement.

5.1 Limitations and Future Research

While this study provides valuable insights, it has certain limitations. The sample was limited to teachers from a single institution, Guangxi Transportation Vocational and Technical College, which may restrict the generalizability of the findings to other vocational colleges with different resources or regional characteristics. Future studies should consider larger, multi-institutional samples to strengthen the external validity of the results.

Additionally, the study relied heavily on self-reported questionnaires and interviews, which are subject to subjective bias. While this provided deep insights into perceptions, it did not directly measure actual teaching performance in digital environments. Future research could employ classroom observations or analysis of digital teaching artifacts to triangulate the self-reported data.

Finally, while the study examined the current status and proposed guidelines, it did not evaluate the long-term effectiveness of these interventions. Future research should implement the proposed guidelines as an action research project to investigate whether targeted training programs effectively improve technical operational skills and digital creativity over time. Investigating the impact of specific interventions, such as gamified training or mentorship programs, could provide further insights into optimizing digital literacy development for vocational educators.

6. References

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