A STUDY ON THE IMPACT OF DIGITAL LITERACY OF TEACHERS IN GUANGXI UNIVERSITIES ON TEACHING EFFECTIVENESS*

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Abstract

This study investigated the impact of digital literacy on teaching effectiveness among university teachers in Guangxi, China, analyzed the effects of its dimensions, and explored demographic moderating factors. From a population of approximately 51,000 faculty members, a stratified sample of 1,550 teachers was surveyed. Data were collected via a questionnaire covering demographics, five digital literacy dimensions- technical operation, information management, digital content creation, cybersecurity awareness, and online interaction- and four teaching effectiveness aspects: academic performance, emotional attitude, classroom participation, and ability development. Items were rated on a five-point Likert scale, with analyses including regression and multi-group structural path analysis.

Results showed that teachers demonstrated moderate digital literacy, with strong technical and information management skills, but weaker content creation ability. Digital literacy significantly and positively influenced teaching

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effectiveness, with information management and online interaction showing the strongest predictive power. Technical skills enhanced classroom interaction, while digital content creation improved engagement. Demographic differences were significant: male and STEM faculty scored higher in technical skills, and vocational college teachers displayed greater adaptability to online teaching. These findings highlight the need for targeted faculty training and the integration of digital technology into higher education practice.

Keywords: Digital Literacy, Teaching Effect, Teacher Competence, Information Technology Application, University Teachers

Introduction

In recent years, the rapid advancement of digital technology has profoundly reshaped higher education in China, influencing not only the modes of knowledge transmission but also the competencies required of university faculty. Digital literacy-defined as the ability to effectively use, manage, evaluate, and create digital resources-has become a critical factor in enhancing teaching quality and fostering active, student-centered learning (Zhang, 2019; Ministry of Education, 2020). The integration of digital tools into teaching practices can improve instructional design, promote interaction, and facilitate innovative pedagogical approaches, ultimately contributing to improved learning outcomes (Li & Wang, 2021).

Despite the nationwide push toward digital transformation, disparities in digital literacy remain across regions, disciplines, and institutions (Chen, 2020). Most studies have concentrated on universities in the economically developed eastern provinces, while less attention has been paid to western regions such as Guangxi. Guangxi, located in southwestern China, reported a GDP per capita of about 48,000 RMB in 2021-less than 60% of the national average-and its gross enrollment rate in higher education (41.2%) lags behind eastern provinces such

as Jiangsu and Zhejiang (above 60%). These economic and educational disparities have restricted investment in digital infrastructure and faculty development, posing challenges for digital transformation in teaching and learning (Guangxi Statistical Yearbook, 2022; Ministry of Education, 2022).

While previous research has generally confirmed a positive link between digital literacy and teaching effectiveness (Zhou, 2022; Basri, 2024), there remains limited empirical evidence on how specific dimensions of digital literacy-such as technical operation, information management, and digital content creation-affect distinct aspects of teaching effectiveness. Furthermore, theoretical perspectives on teaching effectiveness vary constructivist approaches emphasize student engagement and active learning, while outcome-oriented frameworks highlight academic performance and measurable competencies (Biggs & Tang, 2011). These perspectives suggest the importance of examining not only overall relationships but also differentiated effects. Additionally, the moderating roles of demographic factors- including gender, academic rank, discipline, and institution type- remain underexplored, especially in the context of western Chinese higher education.

Objectives

1. To assess the overall level of digital literacy among university faculty members in Guangxi, China.

2. To analyze the effects of different dimensions of digital literacy-namely technical operational skills, information management, digital content creation, online interaction, and teaching innovation-on teaching effectiveness.

3. To examine the moderating roles of demographic variables (gender, age, teaching experience, academic rank, and institution type) in the relationship between digital literacy and teaching effectiveness.

Literature Review

Digital literacy, broadly defined as the ability to access, evaluate, create, and communicate information using digital technologies, encompasses technical, cognitive, and socio-emotional competencies (Ng, 2012). The European Commission (2018), through the DigCompEdu framework, identifies five core dimensions- information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. In higher education, digital literacy extends beyond operational skills to pedagogical integration, enabling educators to design, deliver, and assess technology-enhanced learning (Spante et al., 2018).

A growing body of research confirms the critical role of digital literacy in enhancing teaching effectiveness. Tondeur et al. (2023) demonstrated that digitally competent faculty are more capable of integrating technologies to foster student engagement, collaborative learning, and differentiated instruction. Basri (2024) further noted that STEM disciplines, due to their reliance on simulations, data visualization, and online platforms, often cultivate higher levels of digital competence, leading to improved instructional outcomes.

Teaching effectiveness is typically assessed across multiple dimensions, including student academic achievement, engagement, participation, and skill development (Marsh, 2007). Wu, Zhang, and Li (2020) reported a strong positive association between teachers' digital literacy and these outcomes, highlighting that resource management competence supports targeted instruction, content creation stimulates learner motivation, and online interaction enhances engagement. Demographic and institutional variables can also shape this relationship. Ottenbreit-Leftwich, Glazewski, Newby, and Ertmer (2010) emphasized that age, gender, academic rank, and teaching experience affect both adoption and pedagogical application of digital tools. Institutional type and disciplinary orientation are equally influential: vocational undergraduate

institutions, with practice-oriented curricula, tend to adapt more readily to online teaching, while general undergraduate institutions often emphasize theory, which may limit opportunities for technology integration (He, 2024).

Despite substantial contributions from studies in more developed regions, empirical evidence from less-developed areas, particularly Guangxi, remains limited. Regional disparities in infrastructure and educational resources may constrain faculty digital literacy and its pedagogical applications. This study addresses this gap by examining the digital literacy of university faculty in Guangxi, analyzing its relationship with teaching effectiveness, and exploring the moderating effects of demographic and institutional variables.

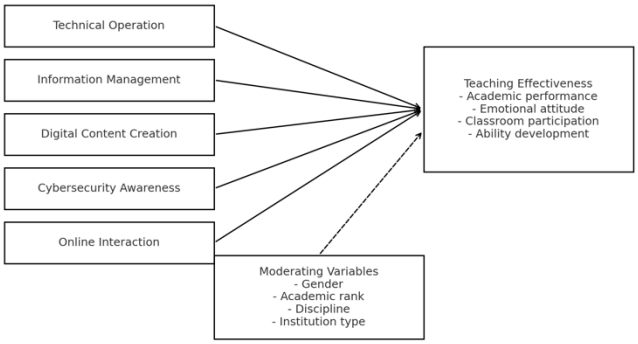

Figure 1: Conceptual model

Methodology

This study adopted a quantitative cross-sectional survey design to examine the relationship between digital literacy and teaching effectiveness among university teachers in Guangxi, China. The research population consisted of approximately 51,000 faculty members across various universities in the region (Guangxi Education Bureau, 2022). A stratified random sampling technique was applied to ensure proportional representation of teachers by gender, age, teaching experience, academic rank, discipline, and institution type. A total of 1,550 valid responses were collected for analysis.

Data were collected using a structured questionnaire divided into three sections: (1) demographic information, (2) digital literacy dimensions—technical competence, information management, digital content creation, online interaction, and teaching innovation, and (3) teaching effectiveness. Items were adapted from validated instruments widely applied in higher education and reviewed by Chinese education experts for contextual relevance. Responses were measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

A pilot test with 50 teachers confirmed clarity, construct validity, and high reliability, with Cronbach's α coefficients above 0.90 for all scales. Anonymity was assured to reduce self-report bias and encourage honest responses.

Descriptive statistics were used to summarize demographics and overall levels of digital literacy and teaching effectiveness. Pearson correlation analysis tested the relationships between the five dimensions of digital literacy and teaching effectiveness. Multiple regression analysis examined the predictive power of each dimension while controlling for demographics. One-way ANOVA was applied to assess group differences. Statistical significance was set at $p < 0.05$.

Results

This section presents the findings of the study in alignment with the three stated research objectives. The analysis begins with an assessment of the overall level of digital literacy among university faculty in Guangxi, followed by an examination of the effects of each digital literacy dimension on teaching effectiveness. It concludes with an investigation of the moderating roles of demographic variables in the relationship between digital literacy and teaching effectiveness. Descriptive statistics, correlation analysis, and regression results are provided to support the interpretation of the findings.

Objective 1: To assess the overall level of digital literacy among university faculty members in Guangxi, China

Table 1: shows the mean scores across the five dimensions

Dimension of Digital Literacy	Mean	SD	Level
Technical Operational Skills	3.12	0.68	Moderate–High
Information Acquisition and Management Skills	3.08	0.71	Moderate
Digital Content Creation Skills	2.91	0.73	Moderate–Low
Online Teaching Interaction Skills	2.95	0.70	Moderate–Low
Digital Teaching Innovation Skills	2.98	0.72	Moderate
Overall Digital Literacy	3.01	0.71	Moderate

Faculty members showed relatively higher proficiency in technical operational skills and information management, while digital content creation and online teaching interaction were weaker. These results highlight priority areas for targeted professional development.

Objective 2: To analyze the effects of different dimensions of digital literacy on teaching effectiveness

The multiple regression analysis demonstrated that all five dimensions of digital literacy exerted significant positive effects on teaching effectiveness ($p < 0.01$). The overall model explained 43% of the variance in teaching effectiveness ($R^2 = 0.43$), indicating a substantial level of explanatory power.

Among the predictors, Technical Operational Skills ($\beta = 0.31$) and Digital Teaching Innovation Skills ($\beta = 0.30$) emerged as the strongest contributors, underscoring the importance of both practical proficiency in digital tools and the ability to creatively integrate technology into pedagogy. Information Management Skills ($\beta = 0.27$) also played a meaningful role, enhancing the organization and accessibility of teaching resources. Meanwhile, Digital Content Creation Skills (β

= 0.18) and Online Teaching Interaction Skills (**β** = 0.15), though smaller in effect, still contributed significantly by fostering student engagement and improving communication within the learning environment.

These findings suggest that while basic technical proficiency remains essential, the greatest improvements in teaching effectiveness stem from innovative and purposeful applications of digital technologies. The moderate R^2 value further indicates that while digital literacy explains a considerable portion of teaching effectiveness, other factors beyond digital competence-such as pedagogical knowledge, institutional support, and student characteristics-may also play important roles.

Table 2: Effects of Digital Literacy Dimensions on Teaching Effectiveness

Dimension	**β** (Standardized Coefficient)	p-value	Interpretation
Technical Operational Skills	0.31	<0.01	Strong positive predictor
Information Management Skills	0.27	<0.01	Enhances quality and accessibility of resources
Digital Content Creation Skills	0.18	<0.01	Stimulates student engagement
Online Teaching Interaction Skills	0.15	<0.01	Improves communication and feedback
Digital Teaching Innovation Skills	0.30	<0.01	Encourages novel teaching strategies

Model Summary	$R^2 = 0.43$		Explains 43% of variance in teaching effectiveness

Objective 3: To examine the moderating roles of demographic variables The analysis found significant moderating effects for all five demographic variables- gender, age, teaching experience, academic rank, and institution type- in the relationship between digital literacy and teaching effectiveness.

Gender: Male faculty scored higher in technical operational skills ($p < 0.01$), suggesting greater openness to experimenting with new tools.

Age: Younger faculty showed stronger digital innovation skills, whereas older faculty had more consistent information management capabilities.

Teaching Experience: Mid-career faculty (5–10 years) demonstrated the strongest link between teaching attitude and digital literacy.

Academic Rank: Professors and associate professors had higher data analysis and evaluation abilities than lecturers.

Institution Type: Faculty in undergraduate vocational institutions exhibited the highest online teaching adaptability, linked to their practice-oriented curriculum.

Table 3: Significant Moderating Effects of Demographic Variables

Demographic Variable	**Moderated Dimension(s)**	**Notable Findings**
Gender	Technical Operational Skills	Male > Female in tool usage proficiency
Age	Digital Innovation Skills	Younger faculty > Older faculty

Teaching Experience	Teaching Attitude – Digital Literacy Link	Strongest in 5–10 years' experience group
Academic Rank	Data Analysis and Evaluation Skills	Higher rank > Lower rank
Institution Type	Online Teaching Adaptability	Vocational > Regular undergraduate

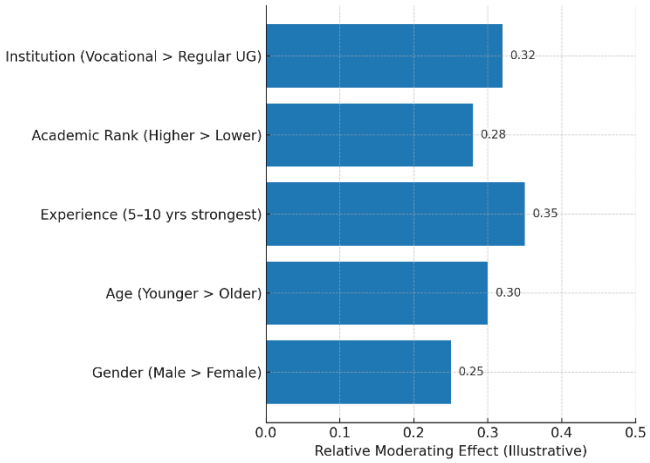

Figure 3: Demographic Moderating Effects on Digital Literacy ⟶ Teaching Effectiveness

Discussion

This study highlights the pivotal role of digital literacy in enhancing teaching effectiveness among university faculty in Guangxi, China. Overall, faculty demonstrated moderate digital literacy, with strengths in technical and information management skills but weaker performance in online interaction and fostering critical thinking. These findings mirror prior studies (Tondeur et al., 2023; Wu et al., 2020), which observed that while basic digital proficiency is common, advanced pedagogical applications remain underdeveloped.

Regression analysis further confirmed that all five dimensions of digital literacy positively influence teaching effectiveness, with technical operational skills and innovation emerging as the strongest predictors. This aligns with Basri (2024), who emphasized the dual importance of technical proficiency and creative integration of technology into pedagogy. Meanwhile, information management, content creation, and online interaction also contributed meaningfully, underscoring the need for a balanced skill set that supports both efficiency and student engagement.

Demographic factors were found to moderate these relationships. Younger faculty excelled in innovation, senior academics showed stronger evaluative skills, and vocational faculty displayed greater adaptability to online teaching. These patterns suggest that professional development should be tailored to faculty backgrounds and institutional contexts rather than adopting a uniform approach.

Despite its contributions, the study has limitations. The cross-sectional design restricts causal interpretations, and reliance on self-reports may introduce bias. Furthermore, focusing solely on Guangxi limits generalizability. Future studies could employ longitudinal approaches, triangulate data with classroom observations, and broaden the scope to diverse contexts.

In conclusion, digital literacy is both a technical and pedagogical competency that significantly shapes teaching effectiveness. Strengthening higher-order digital applications- especially innovation and interactive engagement- through targeted, context-sensitive training will be essential for advancing teaching quality in Chinese higher education.

Recommendation

It is recommended that Universities should prioritize enhancing faculty members' advanced digital skills, particularly in critical thinking, innovative

instructional design, and interactive online teaching strategies. Professional development programs must be tailored to the five dimensions of digital literacy-technical operational skills, information management, digital content creation, online interaction, and teaching innovation-while also being differentiated by demographic and disciplinary needs. For example, female lecturers may benefit from targeted workshops in technology adoption, junior academics from foundational digital training, and senior professors from innovation-focused programs. Likewise, humanities and social sciences faculty should receive greater emphasis on multimedia production, while STEM instructors should be encouraged to integrate interdisciplinary technological approaches.

Vocational universities, which already demonstrate strong adaptability to online teaching, should be supported in documenting and sharing effective practices across the region. At the institutional and policy level, sustained investments in digital infrastructure- including expanded internet bandwidth, upgraded hardware, and increased access to licensed digital resources-are critical to reducing inequalities. These infrastructure improvements should be strategically linked to specific funding mechanisms and regional policy initiatives to ensure long-term sustainability.

To support continuous improvement, the establishment of a regional digital literacy database is recommended. Such a system would enable ongoing monitoring of faculty skills, allow for evidence-based design of targeted interventions, and foster the dissemination of innovative digital teaching practices throughout higher education. By prioritizing initiatives based on both feasibility and expected impact, universities and policymakers can maximize resource efficiency and accelerate the digital transformation of teaching and learning in Guangxi and beyond.

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