Digital Literacy of the Rural Teacher in the Northwestern Guangdong: Current Status, Influencing Factors and Cultivation Strategies

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Abstract: The digital transformation of rural education is a crucial path to advance the revitalization and high-quality development of rural education, while the improvement of rural teachers' digital literacy serves as the core driving force and supporting element in this process. The rural teachers in the northwest Guangdong as the research objects, this study comprehensively adopted the methods of questionnaire survey, text analysis and interview to systematically explore the current situation and influencing factors of their digital literacy. The results show that(1)the overall digital literacy level of rural teachers in this region is above the medium level; (2)individual characteristic variables (such as gender, age, teaching experience, educational background, professional title, etc.) have no significant correlation with teachers' digital literacy;(3)teachers' perceived ease of use and usefulness of technology, as well as external factors, all have a significant positive correlation with teachers' digital literacy level. On this basis, this paper puts forward corresponding improvement strategies from two aspects: stimulating teachers' internal motivation and optimizing the external environment.

Keywords: Northwestern Guangdong; Rural Teachers; Digital Literacy; Influencing Factors; TAM

1. Research Background

As a crucial fulcrum and fundamental project for the implementation of the rural revitalization strategy, the digital transformation of rural education is by no means a simple superposition of digital technology tools. Instead, it relies on the in-depth integration of digital technology and the education ecosystem to reconstruct educational concepts, innovate teaching models, and optimize evaluation systems, thereby improving the quality of rural education. In 2022, China launched the National Education Digitalization Strategic Action and issued the Action Plan for Digital Rural Development (2022–2025), emphasizing the need to advance education digitalization and enhance citizens' digital literacy in the new era. [1] As core actors in the digital transformation of rural education, the improvement of rural teachers' digital literacy serves as a key breakthrough to achieve the revitalization of rural education.

In recent years, a number of research results have been formed regarding the current development status and promotion paths of rural teachers' digital literacy. In terms of the dilemmas in improving rural teachers' digital literacy, Yu Hao conducted a survey on 1,127 rural teachers in Henan Province and found that while rural teachers hold a positive attitude toward digital education, their awareness of digital social responsibility and digital application capabilities are relatively weak, resulting in an overall low level of digital literacy. [2] Zhang Jing et al. also argued that rural teachers have a weak willingness to improve their digital literacy and are not highly motivated to participate in training programs. There are problems such as the single form of digital literacy training for teachers and insufficient integration with disciplines. [3]Some scholars also pointed out that the investment in digital infrastructure of rural schools cannot fully meet the needs of the sustainable digital development of rural education, and external factors such as the inadequate implementation of national policies have become the root causes of the dilemmas in the cultivation of rural teachers' digital literacy.[4]

In the research on paths to improve rural teachers' digital literacy, Kong Xinyu et al. proposed an operational logic of "policy support" to "management system" to "resource guarantee" to "collaborative competence" to "digital

literacy", in which management systems and resource guarantee play a partial mediating role, ultimately empowering the cultivation of rural teachers' digital literacy.[5] Meanwhile, it is necessary to pay attention to the regional characteristics and resource endowments of rural areas, promote localized cultivation in combination with the needs of rural social development, and realize the in-depth integration of digital technology into the education process. [6]Stimulating rural teachers' internal motivation to develop digital literacy and improving the practical transformation effect of training are also important paths.

This study focuses on the northwest region of Guangdong Province, which is relatively underdeveloped economically and generally faces practical difficulties such as backward digital infrastructure, lack of high-quality educational resources, and weak teaching staff. To address the unbalanced and inadequate development of basic education across the province, the People's Government of Guangdong Province proposed in the Action Plan for Promoting the High-Quality Development of Basic Education in Guangdong Province to "implement a full-staff rotation training system for primary and secondary school teachers, and organize primary and secondary school teachers in the eastern, western, and northern regions of Guangdong to receive training in normal colleges and universities within the province". It also strictly implemented the Implementation Measures for the Full-Coverage, All-Round, and Integrative Assistance for the High-Quality Development of Basic Education in the Eastern, Western, and Northern Regions of Guangdong Province, comprehensively integrating high-quality resources from the Pearl River Delta region, teaching and research institutions at all levels, and universities. With township primary and secondary schools in the eastern, western, and northern regions of Guangdong as the key assistance targets, it aims to accelerate the development of basic education in underdeveloped areas. [7]The first round of assistance work started in 2021 and will end in 2025, with one of the tasks being to improve teachers' information technology application capabilities. After five years of construction, has there been any improvement in teachers' information technology application capabilities? This study focuses on three research questions: first, what is the current situation of teachers' digital literacy in the northwest region of Guangdong; second, what factors affect the development of rural teachers' digital literacy; third, based on the current situation and attribution analysis, how to construct specific and effective strategies for cultivating rural teachers' digital literacy.

2. Research Design

2.1 Research Instruments

The questionnaire was designed based on the five dimensions of digital awareness, digital technology knowledge and skills, digital application, digital social responsibility, and professional development specified in the industry standard Teachers' Digital Literacy. Drawing on the Questionnaire on Digital Literacy of Primary and Secondary School Teachers designed by Peng Hongchao et al., appropriate adjustments were made to align with the actual conditions of rural education. [8]The questionnaire consists of four parts: first, personal basic information; second, teachers' digital literacy scale (adopting a 5-point Likert scale); third, influencing factors designed based on the Technology Acceptance Model (TAM) and external variables, along with one open-ended question ("What factors affect the development of rural teachers' digital literacy") to identify effective improvement strategies from the teachers' perspective.

The overall reliability coefficient (Cronbach's α) of the questionnaire reached 0.968, with each dimension exceeding 0.8. The KMO value stood at 0.931, which is higher than 0.8, indicating good reliability and validity for subsequent analysis.

The interview outline was formulated through an extensive literature review, aiming to explore the practical difficulties and support needs encountered by teachers in the process of improving their digital literacy.

2.2 Research Subjects

A questionnaire survey was distributed to rural teachers in northwest Guangdong via the online platform Wenjuanxing (Questionnaire Star), with 203 valid questionnaires retrieved. The basic information of the research subjects is detailed in Table 1.

Interviews were conducted with 5 rural teachers from northwest Guangdong. To ensure sample

representativeness and research feasibility, the interviewees were selected to cover different school stages, teaching experience, professional titles, and disciplinary backgrounds. The interview content mainly focused on teachers' personal basic information, major obstacles and difficulties in improving digital literacy, and the status of training programs organized by schools. All interviews were recorded in full.

To protect personal privacy, all interviewees were anonymized and coded as T1 to T5 (as shown in Table 2).

Table 1. Sample Composition

Demographic Variables	Categories	Number	Percentage (%)
Gender	Male	51	25.12
	Female	152	74.88
Teaching Experience	Less than 5 years	117	57.64
	6–10 years	4	1.97
	11–20 years	40	29.70
	21–30 years	27	13.20
	31 years and above	15	7.39
Educational Background	College diploma or below	3	1.48
	Bachelor's degree	198	97.54
	Master's degree	2	0.99
School Stage	Primary School	179	88.18
	Junior High School	21	10.34
	Senior High School	3	1.48
Professional Title	Unrated	53	26.11
	Level 3 Teacher	4	1.97
	Level 2 Teacher	74	36.45
	Level 1 Teacher	64	31.53
	Senior Teacher	7	3.45
	First-Class Senior Teacher	1	0.49
Discipline	Liberal Arts	92	45.32
	Science	103	50.74
	Arts and PE	8	3.94

Table 2. Interviewee Profile

Code	Gender	Discipline	Teaching Experience (Years)	Professional Title	Educational Background
T1	Female	Primary School English	16	Primary Level 1 Teacher	Bachelor's degree
T2	Male	Primary School Mathematics	2	Unrated	Bachelor's degree
T3	Male	Junior High School Mathematics	13	Senior Teacher	Bachelor's degree
T4	Male	Senior High School Chinese	25	Senior Teacher	Bachelor's degree
T5	Female	Primary School Chinese	8	Primary Level 2 Teacher	Bachelor's degree

In terms of data analysis, SPSSAU was used for statistical analysis of the teachers' digital literacy level data; Nvivo 11 was employed for thematic analysis of the open-ended question responses, so as to reveal the current situation of teachers' digital literacy and the influencing factors in its formation process.

3. Analysis of the Current Situation of Digital Literacy of Rural Teachers in Northwest Guangdong

3.1 The Digital Literacy of Rural Teachers is Above the Medium Level

According to the survey results (as shown in Table 3), the overall mean score of rural teachers' digital literacy is 4.119 (out of a full score of 5), which falls into the above-medium level. This indicates that this group of teachers has a certain foundation of digital literacy, but the development of each indicator is unbalanced. The score differences among the five indicators are not significant: the *digital awareness* dimension ranks the highest with a score of 4.445, followed by *digital social responsibility* at 4.246, while *digital application* scores the lowest at 3.816. These findings suggest that teachers generally recognize the value of digital technology and the importance of digital ethics and norms, yet there remains an obvious

deficiency in their practical teaching application.

Table 3. Mean Scores of Rural Teachers' Digital Literacy and Its Indicators

Dimension	Primary Indicator	Sample Size	Mean Value	Standard Deviation
Teachers' Digital Literacy		203	4.119	0.506
	Digital Awareness	203	4.445	0.480
	Digital Technology Knowledge and Skills	203	3.951	0.698
	Digital Application	203	3.816	0.698
	Digital Social Responsibility	203	4.246	0.476
	Professional Development	203	4.161	0.658

3.1.1 Strong digital awareness

Digital awareness is the prerequisite for driving teachers to actively learn and apply digital technology, which includes *digital cognition*, *digital willingness*, and *digital perseverance*. The survey results show(as Table4) that teachers generally hold a high degree of recognition of the role of digital technology in international competition, education transformation, and teaching innovation. For example, the mean score of Question 10 – *"The future of education is inseparable from digital technology"* – reaches as high as 4.58, with 96.56% of respondents choosing "Agree" or "Strongly Agree", indicating that teachers have a clear judgment on the trend of education digitalization.

The mean score of Question 14, which concerns the exploration of digital technology in teaching practice, is 4.34. In response to Question 15, which investigates whether respondents can actively face difficulties in digital teaching, 88.18% of the subjects selected "Strongly Agree" or "Agree", with a mean score of 4.25. These data illustrate that most teachers not only accept technology in attitude, but also are willing to actively try and overcome obstacles in practice.

Table 4. Mean Scores of Rural Teachers' Digital Awareness and Its Secondary Indicators

Primary Indicator	Secondary Indicator	Sample Size	Mean Value	Standard Deviation
Digital Awareness	-	203	4.445	0.480
-	Digital Cognition	203	4.500	0.496
-	Digital Willingness	203	4.433	0.560
-	Digital Perseverance	203	4.251	0.668

3.1.2 Basic proficiency in digital technology knowledge and skills

Digital technology knowledge and skills form the foundation of digital application. Among all secondary indicators, *digital technology skills* scores the lowest. The mean score of Question 17 – *"I can timely resolve faults of digital devices, software or platforms during teaching"* – is only 3.63 (as shown in Table 5), with 44.33% of respondents selecting "Neutral" or lower options. This reflects that teachers have obvious weaknesses in specific technical operation and troubleshooting capabilities.

Table 5. Mean Scores of Digital Technology Knowledge and Skills and Its Secondary Indicators of Rural Teachers

Primary Indicator	Secondary Indicator	Sample Size	Mean Value	Standard Deviation
Digital Technology Knowledge and Skills		203	3.951	0.698
	Digital Technology Knowledge	203	4.271	0.777
	Digital Technology Skills	203	3.631	0.899

3.1.3 The level of digital application is deficient

Digital application is the core embodiment of teachers' digital literacy, covering the links of teaching design, implementation, evaluation and education. This indicator has the lowest overall score and is a weak link in the current literacy structure(as shown in Table 6).

Rural teachers show strong awareness and ability in creating digital resources (such as multimedia courseware, audio and video materials) and using digital tools for interaction, with the mean scores of the two relevant questions both close to 4. However, their ability to build an environment to support students' remote participation in classroom learning is relatively weak, with only about 63% of the surveyed teachers acknowledging that they possess this ability.

Digital academic evaluation has a relatively low score among secondary indicators: 37.44% of the surveyed teachers believe that they are not very good at "using digital tools (such as online questionnaires, electronic rubrics, online test papers or physiological instruments) to collect data on students' learning performance". Their ability in "making digital charts to explain teaching results to students, parents or other teachers" is particularly weak, with a mean score of only 3.51.

Table 6. Mean Scores of Digital Application and Its Secondary Indicators of Rural Teachers

Dimension	Secondary Indicator	Sample Size	Mean Value	Standard Deviation
Digital Application		203	3.816	0.698
	Digital Teaching Design	203	3.856	0.712
	Digital Teaching Implementation	203	3.844	0.785
	Digital Academic Evaluation	203	3.721	0.772
	Digital Collaborative Education	203	3.799	0.778

3.1.4 Conscious fulfillment of digital social responsibility

The mean score of digital social responsibility is 4.246(as shown in Table 7), second only to digital awareness. This indicates that teachers have a very high level of cognition and behavioral consciousness in terms of ethics, morality and legal norms in cyberspace. Teachers can clearly recognize the boundaries of online speech, consciously abide by online laws and regulations, and guide students to establish correct online values and resist harmful information. They also show a high sense of responsibility and good security habits in self-discipline of online words and deeds and installation of security protection software.

Table 7 Mean Scores of Digital Social Responsibility and Its Secondary Indicators of Rural Teachers

Primary Indicator	Secondary Indicator	Sample Size	Mean Value	Standard Deviation
Digital Social Responsibility		203	4.246	0.476
	Legal and Moral Norms	203	4.597	0.489
	Digital Security Protection	203	4.626	0.595

3.1.5 Proactively participating in professional development

Professional development assesses teachers' ability to use digital technology resources to promote their own and community professional development, including *digital learning and training*, as well as *digital teaching research and innovation*.[9]

Teachers have a strong willingness to actively use digital platforms for professional learning and training exchanges. They can also use data to reflect on teaching to a certain extent and attempt personalized teaching practices. Nevertheless, there is still room for improvement in their ability to deeply integrate technology into the teaching process and form innovative models. (as shown in Table 8)

Table 8. Mean Scores of Professional Development and Its Secondary Indicators of Rural Teachers

Primary Indicator	Secondary Indicator	Sample Size	Mean Value	Standard Deviation
Professional Development		203	4.161	0.658
	Digital Learning and Training	203	4.241	0.662
	Digital Teaching Research and Innovation	203	4.080	0.713

3.2 No Significant Differences in Rural Teachers' Digital Literacy across Personal Characteristics

The digital literacy of rural teachers in northwestern Guangdong showed no statistically significant differences across professional titles, educational backgrounds, or years of teaching experience. Independent samples t-test results indicated that the overall mean score of digital literacy was slightly higher among male teachers than female teachers, with male teachers also scoring marginally higher across all primary dimensions; however, these differences were not statistically significant. (as shown in Table 9)Furthermore, no significant differences in digital literacy were observed among teachers with different professional titles, except in the dimension of digital awareness, where a significant difference did emerge. Overall,

teachers' personal characteristics did not significantly influence their level of digital literacy.

Table 9. Results of ANOVA on Teachers' Gender and Digital Literacy

Dimension	Male (n=51) (Mean ± S D)	Female (n=152) (Mean ± S D)	F	p
Digital Technology Knowledge and Skills	4.01±0.80	3.93±0.66	0.486	0.487
Digital Application	3.92±0.82	3.78±0.65	1.616	0.205
Professional Development	4.17±0.71	3.78±0.65	0.013	0.910
Digital Social Responsibility	4.31±0.58	4.23±0.44	1.137	0.288
Digital Awareness	4.50±0.55	4.43±0.45	0.749	0.388
Teachers' Digital Literacy	4.18±0.62	4.10±0.46	1.111	0.293

*Note: *p<0.05 ** p<0.01

4. Analysis of Influencing Factors on Digital Literacy among Rural Teachers in Northwestern Guangdong

Based on the results from questionnaires, semi-structured interviews, and open-ended text analysis (as show in Table10), this study categorizes the factors influencing the digital literacy of rural teachers in northwestern Guangdong into two aspects: internal factors and external factors. Internal factors primarily refer to teachers' individual perceptions and acceptance of technology, while external factors encompass group atmosphere, social expectations, training support, and equipment resources, among other dimensions.

Table 10. Results of Thematic Analysis Coding

Theme	Sub-theme (Number of Reference Points)
Training	Training Content (46), Training Methods (39)
Work Pressure	Teaching Load (61), Time and Energy (37)
Hardware & Resources	Hardware/Equipment Investment (57), Suitability of Digital Resources (21)

4.1 The Level of Technology Acceptance among Rural Teachers Significantly Affects Digital Literacy

The Technology Acceptance Model (TAM) posits that perceived usefulness and perceived ease of use are key factors influencing attitudes, intentions, and actual behavior toward using information technology. [10]The survey revealed that rural teachers' perceived ease of use and perceived usefulness of technology have a significant positive impact on their digital literacy. As shown in the Table 11, teachers' perceived usefulness and perceived ease of use of digital technology show significant positive correlations with all primary dimensions of teachers' digital literacy. This indicates that whether teachers perceive technology as useful and easy to learn directly affects their willingness to use it and the extent of its application. In the interviews, Teacher T2, although a novice teacher, independently developed a classroom management plugin out of personal interest, effectively improving classroom efficiency. Teacher T3, a senior teacher, used tools such as "Mengkou Yice" APP for learning analytics, stating: *"Now with this software, I just take a photo with my phone, and within minutes all the data is generated. It's immediately clear which knowledge points are weak, so I can quickly adjust the focus of the next stage of review. This has been very helpful for my teaching."* This demonstrates that when a technology accurately addresses a "pain point" in teaching, teachers develop a strong motivation to adopt it and actively integrate it into their teaching practice, thereby continuously enhancing their digital literacy through application. This reflects the positive driving effect of high acceptance levels on teaching behaviors.

Table 11. Pearson Correlation Analysis between Technology Acceptance Model Dimensions and Digital Literacy

	Technology Acceptance Model	Perceived Usefulness	Perceived Ease of Use
Teacher Digital Literacy	0.827**	0.665**	0.806**
Digital Awareness	0.537**	0.560**	0.458**
Digital Knowledge & Skills	0.551**	0.439**	0.562**

Digital Application	0.753**	0.514**	0.791**
Digital Social Responsibility	0.386**	0.476**	0.285**
Professional Development	0.781**	0.660**	0.725**

*Note: * p < 0.05, ** p < 0.01*

4.2 The Combined Influence of External Multidimensional Conditions

4.2.1 Organizational environment and group dynamics generate normative pressure

The explicit requirements for digital development in schools and the demonstration effect among peers jointly form a strong external driving force(as shown in Table12). The survey shows that nearly 69.95% of teachers agree that "schools mandate the study of digital technology-related courses", and 76.85% of teachers report that "colleagues around them are learning and using digital technology".

Such organizational compulsions and group pressures have gradually turned digital application into a "new norm" of teachers' professional behaviors, prompting individuals to take the initiative to learn in order to adapt to the environment and avoid falling behind, and driving the transformation of digital literacy from an "external requirement" to an "internal need".

4.2.2 Social expectations internalized as consensus on professional development

Against the backdrop of digital transformation, mastering digital teaching skills has been widely regarded as a core component of teachers' professional competence. A high percentage of teachers (91.14%) agreed that "the times demand that I acquire relevant skills," reflecting how macro-level social expectations have been deeply integrated into teachers' professional consciousness. This consensus provides a lasting motivational force for continuous learning, corroborating the finding of this study that teachers generally exhibit a strong sense of digital awareness.

Table 12. Correlation Analysis between Teachers' Digital Literacy and External Factors

	External Factors
Teacher Digital Literacy	0.632**
Digital Awareness	0.531**
Digital Knowledge & Skills	0.455**
Digital Application	0.537**
Digital Social Responsibility	0.388**
Professional Development	0.559**

*Note: * p < 0.05, ** p < 0.01*

4.2.3 Structural mismatch between training provision and teachers' actual needs

Training serves as the primary channel for enhancing teachers' digital literacy. However, in-depth interviews and open-ended text analysis reveal a contradictory phenomenon of "high participation rates" coexisting with "low satisfaction." Current training content often suffers from a "one-size-fits-all" approach, focusing on general theories and tool introductions while lacking "prescriptive" guidance deeply integrated with subject-specific pedagogy and authentic classroom scenarios. Teacher T2 noted: "*Trainings talk a lot about concepts, but back in the classroom, I don't know how to implement them.*" Furthermore, "emergency" training conducted for competition purposes further narrows the perceived value of technology application, reducing it to a performative skill rather than a deeply integrated teaching norm. The lack of targeted and practical training severely hampers its intended effectiveness in promoting literacy development.

4.2.4 Excessive workload compresses learning time

Rural teachers in northwestern Guangdong commonly face practical pressures including a high number of teaching hours, heavy task loads, and long working hours. During interviews, Teacher T1 mentioned "*twenty classes per week and a large volume of homework to grade*," while Teacher T4 admitted: "*Creating high-quality digital courseware takes several times longer than traditional lesson preparation. Under the current workload, I can only choose the least effort-consuming way.*" Excessive workload not only compresses the time available for learning and exploration but also psychologically erodes the willingness and energy for pedagogical innovation. This creates a negative cycle of "heavy workload — scarce learning time — slow literacy improvement," constituting a significant barrier to teachers' transition towards digital-age teaching.

4.2.5 Disparities in infrastructure and digital resource conditions across schools

The availability of hardware and resources forms the material foundation for the development of teachers' digital literacy. Some rural schools still face issues such as insufficient network coverage

and outdated equipment. For instance, at Teacher T1's teaching site, "*the internet was only connected this semester, and the interactive whiteboard is merely used as a display screen.*" In contrast, Teacher T2's school has "*interactive whiteboards in every classroom and full network coverage,*" enabling teachers to routinely use resources from platforms like the Subject Network and the National Smart Education Platform for Primary and Secondary Schools. Although teachers generally acknowledge the positive role of digital resources in improving teaching efficiency and stimulating student interest, issues such as the time-consuming nature of resource filtering and variable quality still constrain their willingness to use them, thereby weakening the potential benefits of technology-enabled teaching.

5. Strategies for Enhancing the Digital Literacy of Rural Teachers

Enhancing the digital literacy of rural teachers is a systematic project that requires stimulating internal motivation while providing external environmental support, thereby constructing a comprehensive intervention system characterized by "internal-external synergy and targeted measures."

5.1 Stimulating Teachers' Intrinsic Motivation

Systematically stimulate the endogenous drive of teachers to improve their digital literacy across multiple dimensions: value recognition, competence, and successful experience.

5.1.1 Strengthen contextual demonstration

Teachers' judgment of whether a technology is "useful" stems from its ability to solve real teaching challenges. Therefore, training and promotion should move away from abstract listings of technologies towards a "context-embedded" and "problem-solving" orientation. Schools can organize "micro-case" workshops based on real classroom segments, inviting frontline experts to demonstrate how technology integrates with specific teaching tasks. This allows teachers to intuitively perceive the dual value of technology in "enhancing teaching effectiveness" and "reducing workload."

5.1.2 Provide tiered skill support and immediate feedback

The psychological barrier to technology use often stems from fear of complexity. To lower this threshold, it is essential first to provide "low-entry, progressive" skill resource packages. For example, starting with simple applications like using *Wenjuanxing* (a popular online survey platform) for quick classroom feedback or creating basic interactive courseware with *Seewo Whiteboard* can help teachers gain quick success experiences. Secondly, establishing a school-based technical support mechanism—such as appointing in-school digital mentors or forming technical support teams—ensures that teachers receive timely and effective assistance when encountering difficulties in daily application, preventing frustration caused by isolation. This "on-demand learning" support model is more effective than centralized training in reducing teachers' perceived difficulty and promoting the transition of technology from "trial use" to "routine use."

5.1.3 Improve incentive and evaluation mechanisms

Reform the teacher evaluation system to emphasize the innovative use of digital technology in teaching, student care, and teaching efficiency as key assessment indicators, rather than merely checking attendance in training or certificate acquisition. Provide both moral and material rewards to teachers who achieve outstanding results in digital teaching. Incorporate digital literacy into teacher performance assessment and professional title evaluation systems, establishing honors such as the Digital Teaching Innovation Award or Technology Application Model, to enhance teachers' internal drive for improving their literacy.

5.2 Optimizing the External Environment

The external environment is the key guarantor for translating internal motivation into sustained action. Systematic optimization is needed in three areas: iterative training, the work ecosystem, and the resource foundation.

5.2.1 Establish professional learning communities

As some researchers suggest, methods like "paired assistance programs" and "enhancing platform interaction functions and support systems" [11] can be employed. Expert teachers should not only provide teaching demonstrations but also increase opportunities for interaction with rural teachers. On one hand, this allows for the ongoing collection of process data on the development of rural teachers' digital literacy,

accurately identifying their specific challenges, and enables rural teachers to receive expert guidance based on actual teaching contexts. On the other hand, inter-school collaboration should be fostered to jointly establish regular, structured teacher professional learning communities, promoting a coordinated development mechanism of "urban-rural linkage and school-based implementation." Under this mechanism, activities such as "collaborative lesson planning, dual-teacher classrooms, and joint lesson study" can be organized using regional education cloud platforms or specialized teaching research systems, facilitating the cross-school flow and school-based adaptation of teaching philosophies, digital resources, and practical experience.

5.2.2 Increase investment in hardware and maintenance

In response to inter-school disparities in hardware and resources, the government needs to continuously increase investment to ensure full network coverage and the renewal of basic teaching equipment in rural small-scale schools.

5.2.3 Develop localized digital resource repositories

Regarding resource development, provincial or regional authorities should take the lead in establishing a "localized, high-quality, easily accessible" public service platform for digital education resources. This platform should not only aggregate high-quality resources from national and provincial/city levels but also create specialized sections featuring resources tailored to rural schools and closely aligned with local realities. Resource design must emphasize usability and precise alignment with textbook chapters to lower the application threshold for teachers. Furthermore, a regular mechanism for resource updating, review, and feedback should be established to ensure the practicality of the resources.

6. Conclusion

This study reveals that the overall digital literacy of rural teachers in northwest Guangdong is above the medium level, yet it presents a structural imbalance characterized by "strong awareness but weak application". The development of their digital literacy is mainly driven internally by teachers' technology acceptance and promoted externally by organizational atmosphere, social expectations and other environmental factors. Meanwhile, it is also significantly constrained by inadequate training practicality, heavy workloads and disparities in resource allocation.

This study proposes a series of targeted measures from the two dimensions of internal motivation stimulation and external support optimization, including contextual case demonstration, construction of school-based learning communities, improvement of incentive evaluation mechanisms, and differentiated resource guarantee. These measures are designed to systematically promote the improvement of rural teachers' digital literacy.In addition to deepening the understanding of the formation mechanism of rural teachers' digital literacy—especially the transformation barriers from cognition to practice—this study also provides evidence-based path references for the formulation of teacher development policies targeting underdeveloped regions.

Acknowledgments

Zhaoqing University Higher Education Teaching Reform Project “Design and Implementation of Data Literacy Course Modules for Pre-service Elementary Teachers” (Project No. zlgc202241).

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