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Original Paper

The Professional Development of Rural Primary School Teachers in the Western Sichuan Region under the Background of School Layout Adjustment Research on Digital Support Paths

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Abstract

Under the dual strategic guidance of the digital transformation of education and the revitalization of rural education, the layout adjustment of rural primary schools in the western Sichuan region presents a unique pattern of parallel development of clustered education and small-scale schools providing a safety guarantee. This not only brings opportunities for resource integration for teachers’ professional development but also gives rise to new challenges in digital adaptation. Based on the current situation of digital support for the professional development of rural primary school teachers in the western Sichuan region, this study employs research methods such as literature review, field investigation, and interview to systematically analyze the core characteristics of teachers’ role transformation and demand upgrading after layout adjustment, and reveal the practical predicaments of current digital support in terms of hardware configuration, resource supply, quality improvement, and mechanism construction. Combining theories such as lifelong learning and learning communities, a digital support mechanism integrating hardware balance guarantee, precise resource supply, hierarchical cultivation of qualities,

and collaborative empowerment of mechanisms is constructed, providing practical paths and theoretical references for the high-quality development of rural education and the professionalization of the teaching staff in the western Sichuan region.

Keywords

School layout adjustment, Rural primary school teachers, Professional development, Digital support

The digital transformation of education has become a national strategy. The promulgation of the industry standard "Digital Literacy for Teachers" and the promotion of the "Education Informatization 2.0 Action Plan" have clarified the core position of digitalization in the professional development of teachers (http://www.moe.gov.cn/srcsite/A16/s3342/202302/t20230214_1044634.html;http://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html). In July 2020, six departments including the Ministry of Education jointly issued the "Opinions on Strengthening the Construction of Rural Teacher Teams in the New Era", requiring that new technologies play a promoting role in the new era, the professional development of rural teachers be strengthened, and high-quality rural teachers that meet the requirements of the new era be cultivated. The release of this document has pointed out the direction for the development of rural education (http://www.gov.cn/zhengeo/zhengesku/2020-09/04/content_5540386.htm). As a remote area in western Sichuan, the layout adjustment of rural primary schools in the western part of Sichuan Province is being deeply advanced, forming a two-way model of concentrating in county towns and districts and retaining and running village primary schools well. After the layout adjustment, the large-scale development of boarding schools and the personalized operation of small-scale schools coexist. Teachers are facing new tasks such as cross-disciplinary teaching and remote collaboration, and their demand for digital support is becoming increasingly urgent. Although the western Sichuan region has initially established a digital support foundation, problems such as uneven distribution of digital resources and weak digital literacy of teachers have become prominent due to factors like lagging regional economic development and complex geographical environment, making it difficult to adapt to the new requirements for teachers' professional development after the layout adjustment. How to break through the temporal and spatial limitations and resource bottlenecks of rural teachers' professional development through digital means has become a key proposition for the high-quality development of rural education in the western Sichuan region.

1. The Current Situation of Digital Support for Professional Development of Rural Primary School Teachers in Western Sichuan Region

The digital support mechanism is a series of interrelated support systems and operational rules formed by integrating digital technology, network resources, training systems, management systems and other elements to promote teachers' professional development, including hardware guarantee, resource supply, quality cultivation and collaborative guarantee. The digital support for the professional development of rural primary school teachers in the western Sichuan region has completed the basic framework of

hardware, platforms, and teaching research. However, in the practical implementation, it still faces multiple difficulties such as unbalanced hardware configuration, mismatch between equipment and capabilities, and insufficient sustainability of the assistance mechanism.

1.1 The Hardware Facilities and Equipment Have Been Basically Completed

Most of the boarding schools in the western Sichuan region have been equipped with multimedia facilities, built digital campuses and achieved network coverage. At present, Ganzi Prefecture has completed the construction of a network sharing plan with a total investment of 12.418 million yuan, and has equipped 258 classrooms throughout the prefecture with a full set of intelligent recording and broadcasting equipment. Each live recording and broadcasting classroom is required to ensure a 100-megabit bandwidth streaming capacity, supporting real-time live classroom broadcasting, high-definition recording, and automatic generation of cloud resources. In Dege County, the recording and broadcasting classrooms built with the assistance of Chengdu High-tech Zone are also equipped with an AI analysis system for classroom observation, which can generate data reports such as learning situation time series diagrams and teaching behavior time series diagrams (https://cbgc.scol.com.cn/news/7374731).

1.2 Improve the Platform Resource System and Build a Complementary Shared Network of A and B Platforms

The western Sichuan region has developed A unique AB platform model. The A platform has introduced resources from four prestigious schools in Chengdu and covered approximately 30% of the students through live streaming and implantable teaching. Platform B records high-quality local courses, covering 70% of the students and solving the problem of water and soil incompatibility. Relying on the construction of the school alliance, regions such as Danba County have achieved the remote transmission of high-quality course resources. Some schools have participated in provincial digital training programs, and teachers' digital skills have been initially enhanced.

1.3 Innovation in Teaching and Research Models

Digital teaching and research are shifting from experience-based to data-driven. Resource platforms such as the National Smart Education Platform for Primary and Secondary Schools are gradually being promoted in the western Sichuan region. Some schools are gradually establishing dual-teacher classrooms and master teacher studios, and implementing online training, providing a basic guarantee for teachers' professional development. The recording and broadcasting classrooms in Dege County provide teachers with data such as teacher-student behavior analysis, question analysis, and S-T analysis through the classroom observation AI analysis system, helping teachers accurately reflect on their teaching. The boarding school in Guza District, Kangding City, has implemented a four-lesson cycle (reading lessons, preparing lessons, returning lessons, and discussing lessons) and five implantation models. Teachers have continuously improved their teaching and research levels by collectively watching teaching videos from Chengdu Experimental Primary School and conducting secondary lesson preparation.

2. Challenges Faced by Rural Primary School Teachers in Western Sichuan for Digital Support in Professional Development

2.1 The Hardware Configuration of Schools Is Unbalanced and the Basic Support Is Weak

In terms of the configuration of hardware facilities and equipment, there is a significant hardware gap between small-scale schools in remote mountainous areas and boarding schools in districts. Some rural primary schools have unstable network signals and outdated multimedia equipment, which are difficult to meet the needs of regular digital teaching and research and training. In rural primary schools in the western Sichuan region, due to the complex geographical environment, the hardware maintenance cost is high, the response is slow, and the equipment utilization rate is low. There is a phenomenon of emphasizing construction over usage.

With the development of the economy and the completion of the poverty alleviation project, the state has invested a large amount of funds in education in remote areas. While the hardware environment of schools has been significantly improved, a large amount of digital resources have also been obtained from various channels. However, some rural primary schools have the phenomenon of mismatch in resource supply and insufficient practical value. Most of the existing digital resources are general content, lacking bilingual teaching materials and cultural characteristic resources of the western Sichuan region, and are disconnected from the actual teaching situation in rural areas. The update of resources is not timely, the operation of some digital platforms is complicated, and the digital literacy of rural teachers is insufficient, which makes it impossible for them to effectively utilize digital resources. Some digital platform resources do not match the teaching pace of rural teachers, resulting in an awkward situation where idle resources coexist with demand gaps.

2.2 Teachers' Digital Literacy Varies Greatly and Their Application Ability Is Insufficient

Although the equipment is basically in place, the application ability of teachers remains the biggest shortcoming. There are significant individual differences in digital literacy among rural primary school teachers in the western Sichuan region. Middle-aged and elderly teachers have weak operational skills of digital tools and find it difficult to deeply integrate digital technology with subject teaching. Young teachers lack systematic guidance in digital teaching design and research, and their application of technology remains at a superficial level. The current training content on the use of digital resources is not targeted enough and fails to fully consider the differences between the teaching scenarios in remote areas and the relatively low quality and different actual needs of teachers in ethnic minority areas. As a result, even after the training, there are still a large number of teachers who do not know or are unwilling to use digital resources.

2.3 Mismatch between Training Supply and Teacher Demand

At present, there is a lack of regular digital training mechanisms, incentive mechanisms and guarantee mechanisms, and teachers' internal motivation to participate in digital research and training is insufficient. The collaboration among multiple entities such as the government, schools, universities and enterprises is insufficient, and a closed-loop system covering demand research, resource supply, training

implementation and effect evaluation has not been formed. At present, the training still mainly consists of short-term special lectures, lacking continuous tracking and in-depth guidance. Due to the prominent contradiction between work and study, front-line teachers have shown a tendency towards fragmented training. Through research, teachers are looking forward to a mixed training model that combines short-term concentrated training, online training and school-based practice, as well as on-the-job training at high-quality schools. The mismatch between training supply and teachers' demands leads to poor training outcomes. Some schools still encounter practical difficulties in applying modern information technology means and implementing the inquiry-based teaching required by the new curriculum standards.

2.4 Digital Resources Have the Drawbacks of Poor Language Adaptability and Insufficient Cultural Integration

Although resources from prestigious schools in Chengdu have been introduced, the problem of not adapting to the local environment still exists. In the western Sichuan region, bilingual teaching has become the norm. However, how to effectively integrate ethnic culture and implement bilingual teaching in digital teaching still needs to be explored. Some of the introduced resources have a gap with the cognitive characteristics and life experiences of local students. Teachers need to carry out secondary development, but they lack the corresponding support and time.

3. Analysis of the Reasons Behind the Challenges in Digital Support

3.1 Economic Underdevelopment and Remote Geographical Location in Western Sichuan

As a remote region, the development of educational informatization in western Sichuan heavily relies on government investment. The area suffers from lagging economic growth and limited funding for digital education, making it difficult to support comprehensive hardware upgrades and resource development across the region. Although investment has increased in recent years, the unique mountainous and gorges terrain of western Sichuan results in high network construction costs. With numerous teaching sites spread across the region, available funds still fall short of covering ongoing expenses such as equipment replacement, network maintenance, and resource acquisition. Rural primary schools, constrained by limited budgets, cannot meet diverse demands for digital teaching resources and remain at an early stage of computer- and multimedia-assisted instruction, creating a significant gap compared to education in eastern regions.

Western Sichuan is vast and poorly connected, making inter-school exchanges extremely difficult. This geographical characteristic not only increases the cost of equipment operation and maintenance but also limits the feasibility of centralized teacher training and on-site professional development. Due to regional constraints, students have limited opportunities to engage with the outside world. Even when internet access is available, effective delivery and sharing of high-quality educational resources are hindered by physical spatial barriers.

3.2 Unbalanced Faculty Structure and Shortage of Educational Informatization Talent

Rural primary schools in the western Sichuan region generally face constraints due to an unbalanced teaching staff structure. Surveys reveal that the average age of teachers at boarding schools in the Gudai area of Kangding City is around 40, with some nearing retirement expressing resistance toward learning new technologies: "If a chalkboard and chalk can handle the lesson, why must we learn these new things? We're so old—how could we possibly master them?" Similarly, data from Danba County shows that nearly half of the teachers have over 20 years of teaching experience.

Rural primary schools commonly lack professional information technology personnel, resulting in many teachers being unfamiliar with creating PowerPoint presentations or using multimedia tools. Even when advanced recording equipment is installed, without professional technicians for maintenance and guidance, the full potential of such equipment cannot be realized.

3.3 The Training Content Is Disconnected from the Teachers' Needs, Making It Difficult to Motivate Teachers to Learn

The training content lacks hierarchical and categorized design, focusing mainly on theoretical imparting and lacking practicality. Some teachers have been deeply influenced by traditional teaching concepts and have a low acceptance of digital technologies, even showing resistance. During the learning process, there are application misconceptions of emphasizing form over effectiveness. Teachers expect a mixed training model that combines short-term concentrated training, online seminars, and school-based practical activities, as well as opportunities for on-site follow-up training at high-quality schools. However, the current training is still mainly based on short-term special lectures, lacking continuous tracking and in-depth guidance. Teachers long for long-term pairing relationships with outstanding teachers from other regions to achieve effective transmission of teaching experience. But in reality, assistance often only involves scattered teaching activities, lacking a systematic mentoring mechanism, and thus cannot truly enhance teachers' self-development capabilities.

3.4 Significant Cultural Differences Exist, and the Digital Teaching Evaluation and Incentive System Has Not Yet Been Established

In areas with diverse cultures, bilingual teaching has become the norm. However, there is still a lack of mature solutions on how to effectively integrate local culture and implement bilingual teaching in digital teaching. Language differences cause some students to have difficulties keeping up with the pace during learning, and the existing digital resources are unable to fully meet this demand. Although the western Sichuan region has established a complementary system of platform A (introducing resources from prestigious schools in Chengdu) and platform B (recording local high-quality resources), the actual operation still highlights the problem of a gap between the introduced resources and the cognitive characteristics and life experiences of local students.

The lack of coordination among education, technology, and finance departments, as well as the absence of a cross-departmental collaboration mechanism, leads to low efficiency in resource integration. Through investigation and interviews, it was found that most schools have not established a digital

teaching evaluation and incentive system, and many teachers do not feel the direct benefits of digital teaching, resulting in insufficient enthusiasm for participating in digital training.

4. Strategies for Digital Support for the Professional Development of Rural Primary School Teachers in Western Sichuan

Based on the uniqueness of the layout adjustment of rural primary schools in Western Sichuan and the actual needs of teachers' professional development, drawing on theories such as lifelong learning and learning communities, a four-dimensional digital support mechanism has been constructed, which includes balanced hardware guarantee, precise resource supply, layered cultivation of professional qualities, and collaborative empowerment of mechanisms. Each dimension is interrelated and dynamically coordinated to form a complete support system.

4.1 Build a Solid Foundation for Digital Support and Ensure Balanced Hardware

4.1.1 Differentiate Hardware Allocation Based on Different School Operation Models

For the two school operation models after the layout adjustment in rural primary schools in western Sichuan, implement a strategy of high-quality configuration for large-scale schools and lightweight configuration for small-scale schools. For boarding schools in the area, focus on building smart classrooms and recording classrooms, and equip with high-definition interactive terminals and high-speed networks; for small-scale schools, configure portable multimedia equipment and satellite receiving terminals to ensure basic network coverage. Draw on the experience of intelligent education environment construction in Jiaozuo, Henan Province, and establish a mechanism for regular update and maintenance of hardware equipment.

4.1.2 Establish an Inter-school Hardware Sharing Mechanism

Build a regional educational digital hub at the county level, integrating high-quality hardware resources within the county and establishing an inter-school hardware sharing mechanism. Through remote control and equipment scheduling methods, enable small-scale schools to share and use high-end digital equipment from boarding schools, reducing the cost of individual configuration.

4.1.3 Form a County-level Digital Support Team

Form a county-level digital support team consisting of technical personnel and key teachers, establishing an online consultation + offline on-site technical service model to promptly solve problems encountered by teachers in equipment usage. For remote areas, develop simple troubleshooting guides and video tutorials to enhance teachers' ability to solve problems independently.

4.2 Precise Supply of Digital Resources to Meet the Needs of Localized Development

4.2.1 Form a Team, Develop Localized Digital Resources

Establish a local digital resource development team led by the government, supported by universities, and involving teachers. Relying on the national smart education platform, set up a special resource zone for Sichuan-Western regions to achieve local adaptation and sharing of high-quality resources.

4.2.2 Allocate Resources Reasonably According to Needs

Through research and interviews, understand the different needs of teachers after the layout adjustment, establish a supply system of basic resources, characteristic resources, and personalized resources. Provide large-scale teaching resources and collaborative teaching tools for boarding schools; provide cross-disciplinary integrated resources and lightweight teaching tools for small-scale schools; provide special skills improvement resources for teachers of weak subjects.

4.2.3 Regularly Update Resources to Ensure the Timeliness and Practicality of the Resources

The education bureau of the prefecture or county establishes a resource usage feedback platform, encourages teachers to participate in resource evaluation and optimization suggestions, forming a closed loop of demand research, resource development, application feedback, and iterative optimization. Cooperate with universities and teaching research institutions to update the resource content regularly to ensure the timeliness and practicality of the resources (Li, 2024).

4.3 Stratified and Categorized Cultivation, Overall Improvement of Rural Teachers' Digital Application Capabilities

4.3.1 Establish a Stratified Training System

For teachers of different teaching years and different levels of digital literacy, implement stratified training at the basic level, the improvement level, and the innovation level. The basic level focuses on training in basic operations of digital equipment and resource acquisition skills; the improvement level emphasizes training in digital teaching design and interdisciplinary application; the innovation level focuses on cultivating digital teaching research, resource development, and project research capabilities.

4.3.2 Conduct Diversified Training Models

Adopt a training model combining online and offline, theory and practice, centralized training and school-based research training. Relying on the famous teacher studios in the western Sichuan region or in Sichuan Province, conduct online training. Through dual-teacher classrooms, achieve collaborative lesson planning and teaching observation among urban and rural teachers; utilize summer and winter vacations to conduct concentrated practical training, and provide targeted guidance based on teaching practice cases.

4.3.3 Oriented towards Practice, Enhance Teachers' Digital Teaching Capabilities

During the daily teaching process, regular digital teaching competitions and high-quality lesson case selections are held to encourage teachers to apply digital technologies in their teaching practices. Establish a mechanism for urban and rural teachers' digital assistance, organize urban key teachers to pair up with rural teachers, and enhance rural teachers' digital teaching capabilities through remote listening and evaluation of lessons (Zhao, 2023).

4.4 Mechanism Collaboration Empowerment, Strengthening Sustainable Development Guarantees

4.4.1 Form a Multi-party Collaborative Support Framework

Establish a collaborative support network involving the government, schools, universities, and enterprises. The government is responsible for policy formulation and financial support; schools act as

the implementing entities, formulating personalized support plans; universities provide theoretical support and resource development support; enterprises participate in hardware construction and technical services, forming a multi-party collaborative support framework.

4.4.2 Establish an Incentive and Evaluation Mechanism

Integrate digital teaching capabilities and training outcomes into the teacher assessment and evaluation system, and link them with professional title promotion, merit awards, and commendations. Set up a digital teaching innovation award fund to recognize teachers who have made outstanding contributions in resource development and teaching application. Establish a digital literacy development file for teachers, documenting their growth trajectory and achieving precise support.

4.4.3 Build a Three-level Online Learning Community Mechanism at the County, School District, and School Levels

Relying on regional digital platforms, establish a three-level online learning community at the county, school district, and school levels. Organize cross-school and cross-disciplinary digital teaching research activities, and conduct theme discussions and lesson sharing activities; establish a collaboration community of urban and rural teachers, promoting the sharing of high-quality resources through remote teaching and joint lesson planning, etc.

4.4.4 Build a Language Guarantee Mechanism

Integrate bilingual elements into training materials, resource platforms and technical services to ensure that teachers can participate without obstacles. Cultivate bilingual digital training instructors, conduct digital teaching discussions in different cultural languages, and enhance teachers' ability to conduct digital teaching using different cultural languages.

The changes in the school layout in the western Sichuan region due to the adjustment have raised new requirements for digital support for teachers' professional development. Although there is a certain foundation for digital support within the region at present, there are still multiple difficulties in areas such as hardware balance, resource adaptation, literacy improvement, and mechanism construction, making it difficult to meet the needs of teachers' role transformation and ability enhancement. The four-in-one digital support mechanism integrating hardware balance guarantee, precise resource supply, layered cultivation of literacy, and collaborative empowerment has been constructed based on the characteristics of the western Sichuan region and the adjustment of the layout. Through differentiated configuration, local supply, layered cultivation, and collaborative guarantee, it provides a systematic solution to the digital support dilemma and helps promote the transformation of rural teachers' professional development from external-driven to internal-driven development.

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