



The Intelligent Learning Service System for Rural Preschool Teachers: Its Essence, Structure, and Optimization Pathways

Mohan Liu

School of Education, Jilin International Studies University, Changchun 130117, Jilin, China.

How to cite this paper: Mohan Liu. (2025). The Intelligent Learning Service System for Rural Preschool Teachers: Its Essence, Structure, and Optimization Pathways. *The Educational Review, USA*, 9(12), 962-966.
DOI: 10.26855/er.2025.12.004

Received: November 6, 2025
Accepted: December 2, 2025
Published: December 23, 2025

Corresponding author: Mohan Liu, School of Education, Jilin International Studies University, Changchun 130117, Jilin, China.

Abstract

Early childhood education in rural areas is a crucial link for achieving educational equity and promoting rural development. Currently, rural preschool teachers are facing challenges such as scarce resources, the digital divide, and a severe mismatch between training supply and demand. This study draws on the Radcliffe's (2009) PST framework and combines the adult learning characteristics of rural preschool teachers to construct a five-level progressive scientific integrated intelligent learning service system of perception, resources, interaction, evaluation, and guarantee; it explains the characteristics of highly targeted service customization, preschool professionalism, and effective technical resourcefulness; and proposes four optimization paths: technical support, training optimization, evaluation improvement, and policy guarantee. This system realizes the synergy of advanced intelligent technology, contextualized local resources, and teacher development, providing valuable, sustainable, practical support for the professional growth of rural preschool teachers, the high-quality and balanced development of urban and rural early childhood education, and the inheritance of local culture.

Keywords

Rural preschool teacher; Intelligent Learning; Learning Service System; Logical structure; Pathway Research

Introduction

Rural early childhood education is an important part of the balanced development of the country's basic education. It is also an important part of educational revitalization under the rural revitalization strategy. The United Nations Educational, Cultural, and Scientific Organization has clearly stated that technology empowerment is an important path to narrow the educational gap between urban and rural areas. The "Opinions on Accelerating the Digitalization of Education" jointly issued by the Ministry of Education of China and nine other departments focuses on the shortcomings of rural education and, through measures such as optimizing digital resource supply and conducting targeted training, provides scenario-based and targeted support for the professional development of rural teachers. Now, rural preschool teachers usually have three main problems: they don't have enough professional skills to use local wisdom in teaching; rural infrastructure is weak, which limits them; and they can't easily join high-quality professional training. And the traditional training model doesn't focus on practical work, independent learning, and real practice. Based on this, this research is based on the empowerment of intelligent education technology to explore a teacher's intelligent learning service system suitable for rural scenarios, injecting continuous impetus for the

professional growth of rural preschool teachers and the high-quality and balanced development of urban and rural early childhood education.

1. The Value Connotation of the Intelligent Learning Service System for Rural Preschool Teachers

1.1 The concept of the intelligent learning service system

The intelligent learning service system is an educational support system based on modern information technology. Combine and use advanced educational technology. It gives learners personalized learning experiences and full learning support. Also, this system uses technology tools like big data, cloud computing, and AI. It focuses on helping learners learn on their own and develop in all ways with educational platforms, intelligent teaching management, and interaction between teachers and children. Its core logic is the synergy of three elements: intelligent technology support, localized resource supply, and a multi-dimensional interaction mechanism. For rural preschool teachers, the intelligent learning service system can effectively supplement the deficiencies of traditional educational resources and provide a flexible and convenient learning development platform. Through this platform, rural teachers can not only access rich educational resources but also improve their own educational level and teaching quality through online training, digital teaching tools, real-time feedback, etc., thereby promoting the development of rural preschool education (Sun, Zhang, & Li, 2024).

1.2 The characteristics of the intelligent learning service system for rural preschool teachers

First, service customization needs to match rural teachers' individualized needs. The smart learning service system provides customized services based on these needs. Rural teachers differ in professional skills, teaching experience, and skills in using technology. Thus, flexible, multi-level learning plans are needed to ensure system effectiveness. Its highly customizable content and methods should align with rural children's life experiences (Yang & Zhang, 2025), helping them improve professional abilities amid limited time and resources. Second, combine and use advanced educational technologies to provide personalized learning experiences and full learning support. The system uses technology tools like big data, cloud computing, and AI, focusing on helping learners study on their own and develop in all ways. These goals are achieved through educational platforms, intelligent teaching management, and teacher-child interactions. It also emphasizes child-centered resources, avoiding overly adult-focused or purely theoretical content (Hu, Wang, & Li, 2025). Third, the system has a technical resource feature to provide smart learning support and resource sharing. Rural areas usually have insufficient educational resources, so it is hard for rural teachers to access high-quality resources and tools directly. This system's advantage is using information technology platforms that break geographical limits and bring high-quality teaching resources and tools to rural areas. With cloud platforms, online courses, and digital teaching tools, rural teachers can get rich teaching resources and professional support, enhancing their teaching skills and promoting knowledge sharing in rural education.

2. The Logical Structure of the Intelligent Learning Service System for Rural Preschool Teachers

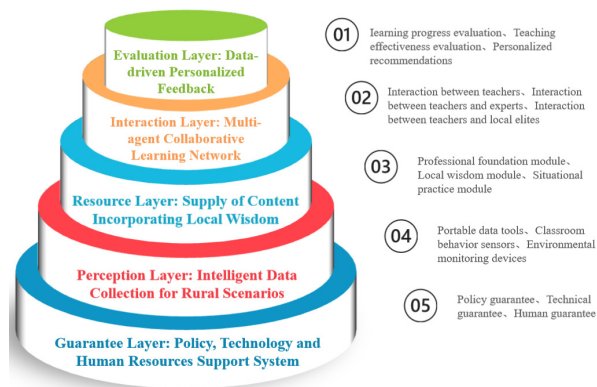


Figure 1. The logical structure of the intelligent learning service system for rural preschool teachers.

Drawing on Radcliffe's (2009) "Teaching-Space-Technology" (PST) framework and considering the learning needs of rural preschool teachers, a five-level progressive logical structure has been constructed, as shown in Figure 1.

2.1 Guarantee Layer: Policy, Technology, and Human Resources Support System

The safeguard layer ensures the sustainable operation of the system and covers three aspects: First, policy guarantee. The system is incorporated into the rural education development plan, smart learning credits are established, and special funds are provided. Second, technical guarantee. Local technical teams in rural areas are trained to be responsible for equipment maintenance and to solve teachers' technical problems (Kormos & Wisdom, 2021). Third, there is human support. Excellent rural preschool teachers are chosen to be "system mentors". They help new teachers use the system. They also hold regular training camps on how to use the system. These activities improve teachers' digital skills.

2.2 Perception Layer: Intelligent Data Collection for Rural Scenarios

The perception layer is the system's database. It collects real-time data about teachers' teaching and learning. The main equipment needs to fit the rural environment. This includes portable data tools such as smart pens with offline storage capabilities and low-power tablets, which address the issue of unstable rural networks; classroom behavior sensors, such as low-cost cameras and voice recorders, which track the frequency of teacher-child interactions and the number of times local cultural content is applied; and environmental monitoring devices, such as temperature and humidity sensors and light sensors, which provide data support for optimizing the classroom environment in rural kindergartens (Tang & Liang, 2024).

2.3 Resource Layer: Supply of Content Incorporating Local Wisdom

The resource layer is the core of the system. It adopts a dual-track design combining professional knowledge and local wisdom, and is divided into three types of modules. The first is the professional foundation module. It covers early childhood development, psychology, and safety management. The second is the local wisdom module. It is developed by scholars from the field of local culture (Wartani & Yuliantina, 2025), such as the agricultural experience science course in the western part of China. The third is the situational practice module. VR simulates rural preschool teaching scenarios to help teachers accumulate practical experience.

2.4 Interaction Layer: Multi-agent Collaborative Learning Network

The interaction layer aims to break the isolated learning state of rural teachers as its core objective: First, there is interaction between teachers. Use online forums and quarterly offline workshops. These fit teachers' fragmented schedules. Second, there is interaction between teachers and experts. Monthly video sessions with early childhood education experts and annual online special lectures are set up to provide targeted professional guidance for teachers. Third, there is interaction between teachers and local elites. A local wisdom knowledge base is established, inviting local elders to record teaching videos such as traditional children's songs and folk games, and supporting teachers to consult on core issues, achieving the transformation of local cultural resources into teaching content (Yoseptry, 2022).

2.5 Evaluation Layer: Data-driven Personalized Feedback

The evaluation layer provides objective and dynamic development feedback through big data analysis. Its core functions include three aspects. First, learning progress evaluation. It automatically tracks the resources completed by teachers, the scores obtained from VR simulations, and generates a skill mastery radar chart. Second, teaching effectiveness evaluation. It correlates classroom behavior data to assess the application effect of the skills learned by teachers (Lv et al., 2025). Third, personalized recommendations. Based on the evaluation results, resources are pushed, and the evaluation results are presented in a visual report format. At the same time, data interfaces are opened to managers to assist in training decisions.

3. The Optimization Pathways of the Wisdom Learning Service System for Rural Preschool Teachers

3.1 Strengthen technical support and resource sharing

The core of the intelligent learning service system is to provide educational support through information technology platforms. Strengthening technical support and resource sharing is an important part of the optimization process. One of the main challenges faced by rural teachers is the insufficiency of infrastructure, especially the limitations of network quality and hardware equipment. Therefore, the main job of optimizing the intelligent learning service system is to improve the platform's usability and stability. First, the cloud platform gives teachers a stable and fast online learning experience. So even in areas with slow internet, teachers can easily use the platform to learn and communicate. Secondly, optimize the user interface design of the platform to make it simpler and easier to use, in order to lower the operational threshold for rural teachers on the technical platform, increase the usage rate of the platform, and promote cross-regional sharing of educational resources. Finally, set up a resource-sharing network. Rural teachers can get local educational resources through this network. Also, they can share experiences and teaching tools with teachers from other places on the platform.

3.2 Enhance the personalization and flexibility of the training system

The professional qualities and technical application skills of rural preschool teachers are relatively low. The traditional uniform training model often fails to meet the individual needs of teachers. Firstly, the intelligent learning service system should offer diverse training methods. These training methods include traditional online courses, short-term micro-courses, live lectures, interactive discussions, and other ways. The training methods are flexible and different. So teachers can choose suitable learning materials based on their own time and interests. Secondly, the intelligent learning service system should provide personalized learning path designs. Through analyzing data, teachers' teaching experience, and other related information. Then design personal learning plans and course materials that fit each teacher. These can help teachers learn more efficiently. Thirdly, the training content should be designed in layers. For young teachers who have just entered the profession, basic education concepts, training and classroom management skills should be provided; for teachers with some experience, courses such as advanced teaching methods and the application of information technology in teaching should be designed.

3.3 Improve the evaluation feedback and improvement mechanism

Evaluation and feedback are indispensable parts of the intelligent learning service system, helping rural teachers understand their own learning progress and teaching effectiveness. First, a real-time learning assessment mechanism is provided. Through classroom interactions and other methods, the system conducts regular evaluations of teachers' learning outcomes. At the same time, the system can automatically make learning reports. These reports help teachers see their strengths and weaknesses clearly and know what to focus on later. Second, the system uses intelligent classroom observation tools. It watches how teachers teach in real time and evaluates the classes using data like how children interact and respond. With regular class evaluations, teachers can get specific feedback on their teaching. Then they can adjust their teaching methods. Third, a teacher mutual evaluation mechanism is established to encourage teachers to evaluate and collaborate with each other. Teachers can join peer reviews on online platforms. They can give feedback and learn from each other.

Funding

14th Five-Year Plan project of Jilin Provincial Education Science for 2025 "Research on the Development and Precise Cultivation Path of Digital Intelligence Literacy of Rural Preschool Teachers in Jilin Province" (Project Number: GH25394); The social science project of Jilin Provincial Department of Education for 2025 "Research on the Construction of Smart Learning Service System for Rural Preschool Teachers in Jilin Province" (Project Number: JJKH20251479SK).

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