

# Digital Transformation Promotes the High-quality Development of Rural Education: Value, Dilemma and Strategy

Suxiang Hu<sup>1</sup>, Jiawang Dai<sup>1</sup>, Haoran Wen<sup>2</sup>, Zanyou Lai<sup>2</sup>, Xuebin Li<sup>1</sup>,  
Liqing Lin<sup>3</sup>, Langchen Chen<sup>1,\*</sup>

<sup>1</sup>School of Law, Guangdong University of Technology, Guangzhou 510006, China

<sup>2</sup>Institute of International Education, Guangdong University of Technology, Guangzhou 510006, China

<sup>3</sup>School of Computer Science, Guangdong University of Technology, Guangzhou 510006, China

\*Correspondence Author

**Abstract:** *The rapid development of digital technology has brought great opportunities for rural education. Systematically promoting the digital transformation of rural education is not only the inherent requirement of the national education digital strategic action, but also the inevitable choice to realize the education power, promote the integrated development of urban and rural compulsory education, and realize the comprehensive revitalization of rural education. Through field investigation, this paper deeply understands the value connotation of digital transformation of rural education, analyzes potential opportunities and challenges, and finally explores a feasible path of digital transformation of rural education. The study found that the introduction of digital technology will greatly enrich rural education resources, promote education equity, and cultivate students' innovative ability. However, in the process of digital transformation of rural education, there are still problems such as lack of digital education resources, cognitive impairment of digital education, homogenization of digital education programs, and insufficient digital literacy of teachers. In order to give full play to the advantages of digital technology in rural education, it is suggested to formulate comprehensive policy support, improve infrastructure construction, strengthen teacher training, and promote the popularization of digital literacy, so as to realize the sustainable development of digital transformation of rural education.*

**Keywords:** Digital Age; Rural Revitalization; Digital Education.

## 1. INTRODUCTION

In the wave of digital transformation, rural education, as an important part of the education system, is also facing unprecedented opportunities and challenges[1]. With the rapid development of new generation information technologies such as artificial intelligence, virtual simulation, new media, Internet of Things, big data, and 5G, more and more rural schools use digital technology to carry out education and teaching activities. Digital transformation provides a new perspective and possibility for the high-quality development of rural education. The derived digital + rural education revitalization, digital + rural education modernization, and the amplification, superposition, multiplication, and continuous spillover effects of digital + rural education high-quality development have gradually emerged[2]. Through the integration of advanced information technology, Internet resources and modern management methods, rural education has been able to cross the limitations of time and space. Realize the sharing of knowledge and the optimal allocation of educational resources. However, while promoting the high-quality development of rural education, digital transformation also faces a series of complex and severe difficulties. In the past few years, many scholars and professionals have conducted in-depth research on the value, difficulties and feasible strategies of rural education in the context of digital transformation, focusing on the following aspects :

First, digital transformation has brought extensive value to rural education. Many studies have emphasized the positive role of digital technology in solving the problem of insufficient rural education resources. Through the online education platform, rural students can obtain learning resources comparable to urban students, breaking regional restrictions and improving the popularity of education. In addition, digital tools can also improve the quality of education and teaching, making rural education more adaptable to the needs of contemporary society. The second is a series of difficulties faced by digital transformation in rural education. One of the primary problems is the existence of the digital divide. Even if the digital transformation has been widely used in cities, there are still problems such as insufficient digital equipment and poor network in rural areas, which makes some rural students unable to fully enjoy the convenience brought by digital education. In addition, teachers' digital literacy is also an urgent problem to be solved, because they need to adapt to new teaching models and digital tools

to better guide students in digital learning. Third, scholars have proposed a series of coping strategies. In terms of the digital divide, the researchers emphasized the joint efforts of the government, enterprises and society to ensure that rural areas can smoothly access digital educational resources by investing in funds and building infrastructure. At the same time, the cultivation of rural teachers' digital literacy has also become the focus of research. Through training and support, the ability of rural teachers to use digital technology is improved.

In general, digital transformation has an important and far-reaching impact on the development of rural education. Although the existing literature focuses on the digital transformation of rural education, it makes a preliminary analysis of the essence[3], level[4], theoretical framework[5], practical logic[6] and challenges and opportunities of the digital transformation of rural education[7]. However, it is not enough to explore why rural education needs digital transformation, how to implement digital transformation, and how to solve the allocation system of urban and rural education resources. In the process of continuing to promote the digital transformation, we need to dig deep into the potential value of the digital transformation of rural education, and pay attention to solving the problems brought by digitalization, so as to realize the high-quality development of rural education. Based on the practical experience of digital transformation of rural education in Meizhou, this study attempts to analyze the positive changes brought by digital transformation to rural education, examine the possible problems and challenges, and put forward a series of feasible strategies and suggestions to promote the sustainable and high-quality development of digital transformation in the field of rural education.

## **2. THE VALUE OF DIGITAL TRANSFORMATION TO RURAL EDUCATION**

The value of digital transformation for rural education is primarily reflected in three main aspects: enhancing educational quality, overcoming geographical constraints, and fostering innovation capabilities. Through online learning platforms and personalized teaching, educational standards can be elevated. Remote education and virtual communication break down geographical barriers, facilitating connections between students and the outside world. Technology education and online resources cultivate innovative thinking and self-directed learning abilities, aiding rural students in better adapting to future societal demands.

### **2.1 Improving the Quality of Education**

Digital transformation can provide more educational resources and learning opportunities for rural education and improve the quality of education. Through digital technology, rural students can access to a wider range of knowledge and information, broaden their horizons and improve their learning effect. Menqian Primary School in Xiamadu Town, Yongzhou, Hunan Province is located in the mountainous area, with less than 20 students and relatively weak teachers. At the beginning of the new semester, Shimenqian Primary School is carrying out the "Cloud Reading Sharing Meeting" with the Minsheng Primary School in the city through multimedia equipment. In the classroom, the teachers and students of the two places' share the experience of participating in happy reading activities during the winter vacation. A screen connects the two classes in urban and rural areas, and the students in the two places have the same class and share educational resources. Our digital teaching equipment is constantly updated, and courseware is constantly enriched. Now we can also carry out a variety of rich (quality education) courses. At present, the Internet access rate of primary and secondary schools (including teaching points) across the country has reached 100 %, 99.9 % of schools have an export bandwidth of more than 100 M, more than three-quarters of schools have wireless network coverage, and 99.5 % of schools have multimedia classrooms. The continuous improvement of digital teaching conditions has effectively contributed to the balanced development of urban and rural education.

### **2.2 Breaking Geographical Restrictions**

Digital transformation can break the geographical restrictions, so that rural students can enjoy the same educational resources as urban students. Through distance education and online learning platform, rural students can interact with urban students to improve together. Digital education first breaks the time and space constraints of education, and forms a new form of ubiquitous learning that can be learned by everyone at all times and everywhere. Secondly, it breaks the limitation of a course and a book, greatly enriches the content of education, and provides an infinite world for learners to absorb and choose the content of learning. The third is to break the limitation of forty or fifty students in a class for several years. Through the establishment of various learning communities, the communication space is greatly expanded. In theory, each student can listen to each teacher's curriculum, and each teacher can serve each student. The fourth is to break the standardized and unified teaching mode, which provides the possibility for the real realization of teaching students in accordance with their

aptitude[8]. The digital education of human-computer integration is an advanced development stage. The boundary between virtual people and physical people with artificial intelligence becomes blurred. They will form a community to participate in teaching activities. Physical teachers and virtual teachers, physical students and virtual students will freely form virtual classes in the virtual learning space to carry out teaching activities. Learning activities in a more flexible form, education model After the classroom boundary of the school is opened up, synchronous teaching and synchronous training can be carried out between schools, so as to solve the problems of lack of teachers in weak schools and teaching points, poor provision of courses, weak teaching ability and low professional development level of teachers. In essence, this is to enhance the overall resilience of the entire education system by narrowing the 'teaching gap' (Zhu, 2023)[9] .

### **2.3 Cultivating Innovative Ability**

Digital transformation can cultivate the innovation ability of rural students. Through digital technology, rural students can participate in more innovative projects and cultivate their ability to solve problems and innovative thinking. People's learning time and space are expanding, the ability to learn is improving, the advantages of people and machines are released, and human-computer interaction has an effect of '1 + 1' greater than 2. Digital tools can make it easier for rural students to obtain and share information. Through the Internet, they can obtain knowledge from all over the world, which helps to broaden their horizons and stimulate innovative thinking. Digital transformation makes online learning platforms easier to promote in rural areas. Students can learn a variety of knowledge and skills through online courses, which helps to cultivate their ability to learn independently and solve problems. Using digital technology, rural schools can provide virtual experiments and simulation environments so that students can carry out practical scientific experiments and engineering projects without being limited by equipment and resources. Digital transformation provides more possibilities for maker education. Students can design and create their own projects through digital tools to develop problem-solving, creative thinking and teamwork skills. Through the online platform, rural students can cooperate and communicate with other students, educators and professionals.

## **3. THE REALISTIC DILEMMA OF DIGITAL TRANSFORMATION OF RURAL EDUCATION**

The digital transformation of rural education faces multiple challenges. Lack of digital education resources, it is difficult to provide a variety of online learning experience ; the cognitive block of educators, students and parents on digital education has affected the application of tools. Homogeneous digital education programs lack innovation ; the lack of digital literacy of teachers limits the effective application of digital tools. To solve these problems, comprehensive measures should be taken to promote the smooth progress of digital transformation of rural education.

### **3.1 Lack of Digital Education Resources**

The economic resources in many rural areas are relatively scarce, and the government's financial investment is insufficient, which leads to insufficient investment in infrastructure construction and educational resource renewal in digital transformation. It is difficult for rural schools to purchase advanced digital teaching equipment, update teaching materials and introduce online education platforms, which limits the pace of digital transformation. On the one hand, there is a realistic deviation in the urban and rural application environment of educational technology. The application of educational technology requires a certain hardware and network equipment environment, including the level of educational equipment, network facilities, the degree of co-construction and sharing of digital resources, and technical support capabilities. Due to the different levels of economic development in urban and rural areas in China, the differences are obvious, which leads to great differences in the construction of network technology and hardware equipment in urban and rural education. In the process of digital technology application, some groups at the top or dominant position can obtain better conditions and development space. The equality of educational process and the equality of results are obscured by technology, which belongs to the 'hierarchical differentiation' phenomenon of educational technology application. Although the current educational theory and practice are making efforts to bridge the 'digital divide' of urban and rural education, there is still a long way to go to truly realize the fairness of the application environment of urban and rural educational technology. On the other hand, the distribution of digital education resources in urban and rural areas is unbalanced, and the main body of urban and rural education has a conceptual area for digital resources.

### **3.2 Blocking of Digital Education Cognition**

In the vast rural areas, school administrators, teachers, students, parents and other attitudes towards digital education are not as highly recognized as expected, and they are always accompanied by negative emotions of doubt and worry, which limits the use of digital education resources and hinders the innovation of rural teaching models[10]. Influenced by the closure of rural areas and traditional concepts, most villagers have cognitive impairment in digital education. This is reflected in their conservative attitude towards new education methods and technologies, believing that traditional education methods are more effective or safer. This cognitive disorder makes digital transformation more difficult to promote in rural areas. The villagers worry that digital education may weaken the traditional way of cultural inheritance and lead to cultural faults. In addition, for some people who do not have personal experience, digital education is also seen as unreliable and unsafe, which in turn affects its acceptance in rural areas. Digital transformation requires strong management concepts and management capabilities to support, including educational institutions and governments. In some rural areas, management concepts and capabilities lag behind the development of digital technology, which makes it difficult for digital transformation to be effectively promoted in rural areas. For example, due to the lack of management ability, there are measures to prohibit mobile phones from being brought into schools, which cannot solve the problems faced by digital transformation.

### **3.3 Homogenization of Digital Education Programmes**

Digital transformation needs to be customized according to the special needs of rural areas. However, many digital education solutions focus more on urban education and fail to meet the actual needs of rural education, which makes it difficult for some general digital education solutions to be effectively applied in rural areas. Digital education programs are usually based on standardized national curricula, and rural areas have unique economic, social and cultural needs. Therefore, digital transformation needs to pay more attention to local culture and local characteristics, and provide educational content that is more in line with the actual needs of rural students. The infrastructure in rural areas is weaker than that in cities, such as incomplete network coverage and unstable power supply. Universal digital education programs often ignore these differences, making it difficult to implement smoothly in rural education scenarios. The family background, cultural environment and subject level of rural students are also very different from those of urban students. General digital education solutions fail to adjust the content and difficulty according to the characteristics of rural students, making it difficult for students to obtain the greatest learning benefits.

### **3.4 The Lack of Teachers' Digital Literacy**

The level of education teachers in rural areas is relatively low. The effective implementation of digital education requires teachers to have corresponding technical and teaching abilities. However, teachers in rural areas generally face the problem of insufficient digital literacy. The lack of understanding of digital tools and teaching methods makes it difficult for teachers to effectively integrate digital technology into teaching practice, thus affecting the smooth progress of digital transformation. Rural teachers generally lack awareness of new technologies in digital transformation. Due to the lack of timely training and updating, many rural teachers have limited understanding of modern digital tools, educational software and online resources, and it is difficult to give full play to the potential of these tools in teaching. Rural teachers often lack the experience and ability to integrate digital technology in the classroom. They are aware of certain educational applications or online teaching resources, but there are certain difficulties in integrating them organically into instructional design to improve teaching quality and attract students' attention. In some rural areas, the network infrastructure is relatively weak, and teachers face the problem of network instability. This not only limits their ability to use online education resources, but also increases the difficulty of technology application, because teachers need to overcome the uncertainty of the network environment. For digital transformation, teachers need to have the ability to design digital courses. This includes the development of online education lesson plans, the use of multimedia teaching tools, the design of online interaction skills, and rural teachers often lack professional training and support in this regard.

## **4. CASE ANALYSIS: THE SUCCESSFUL PRACTICE OF DIGITAL TRANSFORMATION OF RURAL EDUCATION**

As a typical representative of the digital transformation of rural education, Meizhou Jingxin Middle School has made positive attempts and innovations to realize the balanced distribution of high-quality educational resources and promote the all-round development of students. Its successful practice in digital transformation provides

experience for other rural schools.

#### 4.1 Case Overview

Jingxin Middle School was founded in 1956 and is a public rural junior middle school. From its inception to the present, it has gone through five stages : the founding period, the development period, the ten-year period of turmoil, the period of stability and rejuvenation, and the period of prosperity. The school has 11 teaching classes, a total of 467 students, a total of 51 teaching staff, 49 full-time teachers, 13 senior teachers, and the academic qualification rate is 100 %. The campus covers an area of 55629m<sup>2</sup>, with an average area of 120m<sup>2</sup>. The construction area is 8370 m<sup>2</sup>, and the average area is 18 m<sup>2</sup>. The school has complete facilities and functional classrooms, with a total of more than 10,000 books and materials.

#### 4.2 Case Analysis

According to the "Guangdong Province Primary and Secondary School Teachers' Information Technology Application Ability Improvement Project 2.0 Pilot School Construction and Management Measures (Trial)," Jingxin Middle School has carried out construction work in stages and at different levels. Relying on Meizhou Education Public Resource Service Platform, it has carried out multi-technology integration and innovative teaching, and realized the information integration and innovation of teaching, scientific research and management. With the goal of "improving teachers' information technology teachers' ability and helping school teaching innovation," based on "promoting the whole school," it has established a training community of "backbone guidance, teacher mutual assistance and school guidance" to ensure the implementation of the whole school information technology application promotion project.

Cultivate the school information innovation learning environment, through the 'Meizhou Education Public Service Platform', 'Renrentong APP', 'Teaching Assistant', 'Interactive Classroom', 'Xiwo Whiteboard', 'Xiwo Teaching Assistant' implanted efficient classroom teaching mode, promote the innovation of teaching mode under the environment of multi-technology integration. Focus on the construction and improvement of the school's network facilities and hardware equipment, such as broadband networks, computers, interactive whiteboard, etc., to support digital teaching and learning.

Cultivate a group of famous teachers with modern educational ideas and educational wisdom, proficient in the application of information technology. Improve the school-based teaching resource library ; actively develop and utilize national, provincial and municipal education resources public service platform resources and provincial information technology capability improvement project platform, enrich teaching resources, and actively create and deliver excellent resources.

To promote teaching by research, improve teachers' ability to apply information technology to learning situation analysis, teaching design, learning method guidance and academic evaluation. Provide teachers with corresponding training and support, help them master digital teaching tools and platforms, improve their teaching level and digital literacy, so that they can better apply digital technology to teaching. The following figure is the attitude of parents in Jingxin Middle School towards teachers' use of digital technology to assist teaching.

Promote learning by teaching, solve the key and difficult problems of education and teaching, change students' learning methods, and meet the needs of personalized development. Encourage students to actively participate in and interact, such as through online discussions, collaborative learning platforms, etc., to stimulate students' interest and initiative in learning, improve learning outcomes and performance. Through the digital platform to collect and analyze teaching data, understand students' learning situation and needs, and then provide personalized learning support and teaching feedback, promote students' individual development and performance improvement.

Focusing on thematic training, we carry out school-based research and training of information-based teaching such as teaching case discussion and classroom record analysis, so as to improve teachers' information technology application ability, subject teaching ability and professional independent development ability, and can skillfully use a variety of information technology in education and teaching. It focuses on the development and integration of rich digital teaching resources, including teaching videos, online courses, teaching games, etc., to provide rich and diverse learning materials and methods to help students learn and understand better. The school will upload the curriculum and plan of a semester to the school area network, and usually follow the system of collective lesson preparation. One to two people upload to the school domain network after preparing lessons, communicate and

modify together to achieve information sharing. A class group meets to discuss how to teach, and can go to the school network to view themselves without listening clearly, so as to achieve a unified pace. The teacher can design the course from the beginning to the end, but the workload is large, so the division of labor and cooperation, such as lesson preparation courseware or content design and so on by a person, and then by other teachers to see, make suggestions to modify.

#### **4.3 Case Summary**

Jingxin Middle School has a certain representativeness in the digital transformation of education, which provides a model for the digital construction and development of other schools. On the road of actively exploring digital education and teaching, we should conform to the trend of digital education going to the countryside, strengthen the digital transformation of schools and actively carry out digital education with the help of the policy support of the provincial education department and the opportunity of college students going to the countryside.

### **5. THE OPTIMIZATION PATH OF DIGITAL TRANSFORMATION OF RURAL EDUCATION**

The digital transformation of rural education is not a single transformation of technology or a certain aspect, but a comprehensive transformation. It is not enough to rely solely on external forces to develop rural schools and improve the quality of rural education in Jingnan Town. Basically, it is necessary to stimulate the endogenous ability and development motivation of rural education subjects. Empowering rural education with digitalization, activating the vitality of rural schools, and narrowing the gap between urban and rural areas, we should start with the overall design, provide digital infrastructure, build a digital social practice base, and promote the digitization of educational resources.

#### **5.1 Strengthen the Construction of Digital Education Infrastructure**

Infrastructure construction : Strengthen investment in infrastructure in rural areas, especially improve network coverage and stability, to ensure the smooth use of digital education resources.

Popularization of digital devices : formulate policies to promote the popularization of digital devices in rural schools, provide financial support or subsidies for the purchase of digital devices, and ensure that students and teachers can easily obtain digital learning tools.

Public-private cooperation : encourage public-private cooperation, introduce the support of enterprises and non-profit organizations, jointly promote the sharing of digital education resources in rural areas, and provide free or preferential digital education platforms and learning resources.

#### **5.2 Transforming the Traditional Concept of Digital Education**

Localized education content : formulate and promote localized digital education content, fully consider the cultural and living background of rural students, and make the content more attractive and practical.

Community participation : strengthen the participation and publicity of rural communities, improve the cognitive level of parents and villagers on digital education through seminars and interactive activities, and solve the problem of cognitive impairment.

Education propaganda : to carry out targeted education propaganda work, emphasizing the positive role of digital education in improving the comprehensive quality and future development of rural students.

#### **5.3 Develop Customized Digital Education Programs**

Policy support : Develop policies to encourage and support digital education service providers to promote the development and application of customized digital education programs for the special needs of rural areas.

Industry cooperation : The government can promote the cooperation between the digital education industry and local educational institutions to understand the actual needs, jointly develop customized digital education programs, and provide corresponding resources and support.

#### 5.4 Improve the Digital Literacy of Rural Teachers

Professional training : Provide professional digital education and training programs to help rural teachers improve their ability and confidence in the application of digital technology, and ensure that they can use digital tools and teaching methods skillfully.

Experience sharing : Create a digital education experience sharing platform, so that teachers with successful experience can share experience with rural educators, and promote the circulation of information and experience.

Tutor system : Establish a digital education tutor system, with experienced teachers as tutors to guide and support the application practice of rural teachers in digital transformation.

### 6. CONCLUSION AND PROSPECT

The digital transformation of education in rural areas is a task with far-reaching value and challenges. Through digital transformation, we have the opportunity to break the geographical restrictions, provide more abundant educational resources for rural students, improve the quality of education, and promote social equity. However, the dilemma is also obvious, including unbalanced educational resources, cultural cognitive barriers, lack of customized programs, and insufficient digital literacy of teachers. In the process of overcoming these difficulties, all parties need to work together to find innovative solutions to ensure that digital transformation can not only be promoted, but also achieve substantive results.

In the future, the digital transformation of education in rural areas will make new breakthroughs in many aspects. First of all, with the continuous development of technology, digital education tools will be more intelligent, personalized, and better adapt to the learning needs of rural students. Secondly, the investment of government and social institutions will be further increased to improve infrastructure and educational resources in rural areas. At the same time, digital transformation will further promote the economic development of rural areas and provide more employment opportunities for students. In order to achieve this vision, all parties need to work together to form a joint force. The government needs to strengthen policy support, provide more investment and resources to ensure digital education.

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