

STRATEGIES FOR PROMOTING URBAN-RURAL EDUCATIONAL EQUITY IN THE INTELLIGENT TRANSFORMATION OF PRIMARY EDUCATION IN QINZHOU, GUANGXI

Qianyun Chen¹, Ganratchakan Lertamornsak²

¹Graduate School, Suan Sunandha Rajabhat University, Bangkok, Thailand,

E-Mail: s67561802042@ssru.ac.th

²Graduate School, Suan Sunandha Rajabhat University, Bangkok, Thailand,

E-Mail: ganratchakan.le@ssru.ac.th

ABSTRACT

This study aims to explore the current situation of intelligent transformation of primary education in Qinzhou, Guangxi and the urban-rural education equity gap, and propose targeted promotion strategies under the background of education digitalization. Taking 140 urban and rural primary school teachers in Qinzhou as the research population, 103 teachers were selected as questionnaire samples by the Krejcie & Morgan method, and 5 education administrators were selected as interview samples by purposive sampling. A five-dimensional research framework including teachers, students, educational resources, educational quality, and policy management was constructed. The results show that the overall level of urban-rural educational equity promotion in the intelligent transformation of Qinzhou's primary education is moderate (Mean= 3.45, S. D. = 0.69), with teachers and policy management factors at a high level, and educational resources as the weakest link. Targeted optimization strategies are proposed to solve the problems of unbalanced resource allocation, insufficient digital literacy of rural teachers, and low localization of digital resources, providing practical reference for the high-quality and balanced development of primary education in western coastal small and medium-sized cities in China.

Keywords: Intelligent Transformation; Primary Education; Urban-Rural Educational Equity; Qinzhou Guangxi

INTRODUCTION

In the era of deep integration of intelligent technologies and education, promoting urban-rural educational equity has become the core requirement for the high-quality development of basic education in China. Primary education, as the cornerstone of the education system, its balanced urban-rural development is the key to realizing educational equity. Qinzhou, a core coastal city in the Guangxi Beibu Gulf Economic Zone, has the typical characteristics of coastal resource advantages and unbalanced urban-rural educational development. Under the drive of artificial intelligence, big data and smart education platforms, the traditional resource allocation and teaching implementation mode of Qinzhou's urban and rural primary education can no longer meet the demand of educational equity, and it is urgent to leverage intelligent technology to empower the reconstruction of rural primary education resource supply system.

Intelligent technology has opened up new paths for the equitable development of urban and rural primary education, and has created important opportunities for Qinzhou's educational

transformation. Through the national smart education platform and remote live broadcast teaching mode, rural primary schools can access high-quality urban teaching resources, and big data analysis can realize personalized learning diagnosis, making up for the shortage of differentiated teaching in rural areas. However, constrained by regional economic disparities, teacher competency levels and technological application capabilities, Qinzhou's primary education intelligent transformation still faces problems such as unbalanced urban-rural smart hardware allocation, low digital literacy of rural teachers, and insufficient localization of digital resources, and the practical effect of technological empowerment in promoting educational equity is not fully exerted.

Based on educational equity theory, digital inclusion theory and collaborative development theory, this study constructs a five-dimensional research framework to analyze the current situation of urban-rural educational equity in the intelligent transformation of Qinzhou's primary education through mixed research methods of questionnaire survey and in-depth interview, explores the core influencing factors and practical challenges, and proposes targeted promotion strategies. The research not only provides precise guidance for Qinzhou's primary education intelligent transformation and urban-rural educational equity promotion, but also offers a replicable practical model for similar western coastal small and medium-sized cities, enriching the theoretical and practical research on the digital development of basic education in China.

OBJECTIVE

1. To study the level of the strategies for Promoting Urban-Rural Educational Equity in the Intelligent Transformation of Primary Education in Qinzhou, Guangxi
2. To propose the the strategies for Promoting Urban-Rural Educational Equity in the Intelligent Transformation of Primary Education in Qinzhou, Guangxi

METHODOLOGY

This study adopts a mixed research method combining quantitative and qualitative research, with the urban and rural primary education in Qinzhou, Guangxi as the research object, to systematically analyze the strategies for promoting urban-rural educational equity in the intelligent transformation. The research process includes population and sample selection, research tool design, data collection and data analysis.

Population and Sample

Research Population: 140 teachers from urban and rural primary schools in all counties and districts of Qinzhou City, Guangxi.

Questionnaire Sample: Using the Krejcie & Morgan sample size determination method (1970), 103 teachers were selected as the questionnaire sample, ensuring the representativeness of the research sample.

Interview Sample: 5 core staff from the Basic Education Management Department of Qinzhou Municipal Education Bureau were selected by purposive sampling, all with more than 5 years of primary education management experience and in-depth participation in Qinzhou's smart education policy formulation and implementation, including education bureau administrators, school principals and key teachers of educational technology.

Research Tools

Research Questionnaire

Designed by the researcher, it is divided into two parts and uses a 5-point Likert scale for evaluation (1=lowest level, 5=highest level):

Personal Information Part: Collects the respondent's gender, highest educational background, teaching subjects and work experience, with a total of 4 items.

Core Research Content Part: Based on the five research dimensions of teacher factors, student factors, educational resource factors, educational quality factors and policy management factors, it designs 8 items for each dimension, with a total of 40 items, covering the core content of urban-rural educational equity promotion in the intelligent transformation of primary education.

Expert Interview Form

Based on the five research dimensions of the questionnaire, semi-structured interview questions are designed to explore the practical problems, root causes and optimization suggestions of urban-rural educational equity promotion in the intelligent transformation of Qinzhou's primary education, with a total of 40 interview items corresponding to the questionnaire.

Validity and Reliability Test

Content Validity: The questionnaire was reviewed by 3 experts in the field of basic education and educational technology, and the Item Objective Congruence (IOC) value was 0.67-1.00, indicating good content validity.

Reliability Test: A pilot study was conducted with 30 non-sample teachers, and the Cronbach's Alpha coefficient of the questionnaire was 0.9316, showing high internal consistency and reliability.

Data Collection

Questionnaire Survey: The questionnaire was distributed to the sample teachers through online and on-site methods, with 103 valid questionnaires recovered, a recovery rate of 100%.

In-Depth Interview: Face-to-face in-depth interviews were conducted with 5 selected education administrators, each interview lasting 30-40 minutes. The interviews were recorded with the permission of the interviewees, and the interview content was sorted out, coded and used for content analysis.

Data Analysis

Quantitative Analysis: Using statistical software, the basic information of the respondents was analyzed by frequency and percentage; the five research dimensions were analyzed by mean ($\bar{x}$) and standard deviation (S.D.), and the implementation level was judged according to the mean value: 1.00-1.50=lowest, 1.51-2.50=low, 2.51-3.50=moderate, 3.51-4.50=high, 4.51-5.00=highest.

Qualitative Analysis: The interview content was coded and categorized according to the five research dimensions, and the practical problems, core influencing factors and optimization suggestions of urban-rural educational equity promotion were summarized through content analysis, so as to supplement and explain the quantitative research results.

RESULTS

Basic Information of Respondents

The 103 valid respondents show the following characteristics in basic information (Table 1), reflecting the representativeness of the sample in the overall research population:

Gender Distribution: 43 males (41.75%) and 60 females (58.25%), with more female teachers, in line with the gender characteristics of primary school teachers in China.

Educational Background: Mainly master's degree, accounting for 67.96% (70 people); bachelor's degree accounts for 25.24% (26 people); doctoral degree accounts for 6.80% (7 people), with a high overall educational level.

Teaching Subjects: 65.05% (67 people) teach Chinese, Math and English, the core subjects of primary education; 34.95% (36 people) teach Science, Sports, Arts and other subjects, covering all primary school teaching subjects.

Work Experience: The structure is reasonable, with 28.16% (29 people) having 11-15 years of experience, 25.24% (26 people) having 6-10 years of experience, and the proportion of teachers with different work experience is relatively balanced.

Table 1 General Data Analysis of Respondents (n=103)

General Information	Frequency	Percentage (%)
Male	43	41.75
Female	60	58.25
Bachelor's Degree	26	25.24
Master's Degree	70	67.96
Doctoral Degree	7	6.80
Chinese / Math / English (Teaching Subjects)	67	65.05
Science / Sports / Arts, etc. (Teaching Subjects)	36	34.95
Under 6 years (Work Experience)	12	11.65
6-10 years (Work Experience)	26	25.24
11-15 years (Work Experience)	29	28.16
16-20 years (Work Experience)	21	20.39
More than 20 years (Work Experience)	15	14.56

Mean and Standard Deviation Analysis of Research Dimensions

The overall mean value of the strategies for promoting urban-rural educational equity in the intelligent transformation of Qinzhou's primary education is 3.45 (S.D.=0.69), at a moderate level (Table 2). The mean values of each dimension are ranked from high to low as follows: Factors of School Teachers (3.62, high) > Factors of Policy and Management (3.55, high) > Factors of School Students (3.47,

moderate) > Factors of Educational Quality (3.38, moderate) > Factors of Educational Resource (3.25, moderate). It can be seen that teachers and policy management are the advantageous dimensions, while educational resources are the weakest link restricting the promotion of urban-rural educational equity.

Table 2 Mean and Standard Deviation Analysis of All Research Dimensions (n=103)

Research Dimensions	$\bar{x}$	S.D.	Evaluation Level
Factors of School Teachers	3.62	0.65	High
Factors of School Students	3.47	0.71	Moderate
Factors of Educational Resource	3.25	0.78	Moderate
Factors of Educational Quality	3.38	0.69	Moderate
Factors of Policy and Management	3.55	0.62	High
Total	3.45	0.69	Moderate

Factors of School Teachers ($\bar{x}$ =3.62, S.D.=0.65, High Level)

Teachers perform the best in Teachers' Awareness and Acceptance of Smart Education (3.82, high), followed by Teachers' Competence in Intelligent Instructional Design and Classroom Implementation (3.65, high). The lowest score is Targeted and Effective Informatization Training for Rural Teachers (3.12, moderate), indicating that rural teachers have a high recognition of smart education, but the targeted training system is imperfect, which is the core bottleneck of teacher team construction (Table 3).

Table 3 Mean and Standard Deviation of Factors of School Teachers (n=103)

Evaluation Items	$\bar{x}$	S.D.	Evaluation Level
Teachers' Awareness and Acceptance of Smart Education	3.82	0.59	High
Teachers' Competence in Intelligent Instructional Design and Classroom Implementation	3.65	0.63	High
Teachers' Digital Literacy and Application Competence of Intelligent Technologies	3.58	0.67	High

Evaluation Items	$\bar{x}$	S.D.	Evaluation Level
Teachers' enthusiasm for participating in the development of intelligent educational resources	3.52	0.68	High
Teachers' Cross-Regional Teaching Research and Urban-Rural Exchange and Cooperation Capabilities	3.47	0.72	Moderate
Teachers' ability to utilize big data for learning diagnostics	3.36	0.75	Moderate
Targeted and Effective Informatization Training for Rural Teachers	3.12	0.85	Moderate

Factors of School Students ($\bar{x}$ =3.47, S.D.=0.71, Moderate Level)

Students have the strongest Acceptance and Adaptability to Intelligent Teaching Models (3.82, high), and the lowest score is The Degree of Disparity in Smart Technology Application Between Urban and Rural Students (3.12, moderate), reflecting that rural students can accept intelligent teaching models well, but the digital divide between urban and rural students is obvious, which restricts the balanced development of students' comprehensive quality (Table 4).

Table 4 Mean and Standard Deviation of Factors of School Students (n=103)

Evaluation Items	$\bar{x}$	S.D.	Evaluation Level
Students' Acceptance and Adaptability to Intelligent Teaching Models	3.82	0.59	High
Students' ability to utilize digital resources for self-directed learning	3.65	0.63	High
Students' Basic Application Skills in Intelligent Technology	3.58	0.67	High
Development Level of Students' Comprehensive Literacy and Innovative Thinking	3.52	0.68	High
Students' Autonomous Learning and Problem-Solving Abilities	3.47	0.72	Moderate
Students' ability to utilize smart tools for inquiry-based learning	3.36	0.75	Moderate
The Degree of Disparity in Smart Technology Application Between Urban and Rural Students	3.12	0.85	Moderate

Factors of Educational Resource ($\bar{x}$ =3.25, S.D.=0.78, Moderate Level)

This dimension is the lowest among all research dimensions. Teachers perform best in Teachers' ease of accessing smart teaching resources (3.57, high), and the lowest score is The Local Adaptability of Digital Resources for Rural Students (2.86, moderate). In addition, Urban-Rural Equity in Smart Teaching Hardware Allocation (2.98, moderate) also has a low score, indicating that the main problems of educational resources are unbalanced urban-rural hardware allocation and serious lack of localization of digital resources (Table 5).

Table 5 Mean and Standard Deviation of Factors of Educational Resource (n=103)

Evaluation Items	$\bar{x}$	S.D.	Evaluation Level
Teachers' ease of accessing smart teaching resources	3.57	0.68	High
Improvement of the Mechanism for Updating and Maintaining Educational Resources	3.48	0.72	Moderate
The Abundance and Accessibility of Digital Course Resources	3.42	0.75	Moderate
Integration and Utilization of Off-campus Intelligent Educational Resources	3.31	0.79	Moderate
The completeness and stability of campus network infrastructure	3.15	0.84	Moderate
Provision of Experimental and Practical Intelligent Educational Resources	3.02	0.87	Moderate
Urban-Rural Equity in Smart Teaching Hardware Allocation	2.98	0.89	Moderate
The Local Adaptability of Digital Resources for Rural Students	2.86	0.92	Moderate

Factors of Educational Quality ($\bar{y}$ =3.38, S.D.=0.69, Moderate Level)

Teachers perform best in The Effect of Intelligent Teaching Model on Enhancing Classroom Instruction Efficiency (3.56, high), and the lowest score is The Balanced Development Level of Urban and Rural Classroom Teaching Quality (3.18, moderate). It shows that intelligent technology can effectively improve the efficiency of rural classroom teaching, but the gap in teaching quality between urban and rural primary schools is still obvious, and the implementation effect of intelligent teaching models such as dual-teacher classrooms needs to be improved (Table 6).

Table 6 Mean and Standard Deviation of Factors of Educational Quality (n=103)

Evaluation Items	$\bar{x}$	S.D.	Evaluation Level
The Effect of Intelligent Teaching Model on Enhancing Classroom Instruction Efficiency	3.56	0.67	High
The School's Monitoring and Evaluation Capabilities for Intelligent Teaching Quality	3.52	0.68	High
The Supporting Effect of Intelligent Technology on Individualized Teaching	3.48	0.69	Moderate
The Impact of Intelligent Technology on Academic Performance Enhancement	3.45	0.71	Moderate
Effectiveness of Cultivating Students' Core Competencies (Autonomy, Innovation, and Collaboration)	3.42	0.73	Moderate
Implementation Effect of Teaching with Dual-Teacher Classroom and Other Intelligent Models	3.36	0.75	Moderate
The Degree of Disparity in Comprehensive Development Outcomes Between Urban and Rural Students	3.21	0.80	Moderate
The Balanced Development Level of Urban and Rural Classroom Teaching Quality	3.18	0.82	Moderate

Factors of Policy and Management ($\bar{x}$ =3.55, S.D.=0.62, High Level)

This dimension is the second highest after teacher factors. The best performance is Supportive Measures for Local Smart Education Development Policies (3.86, high), followed by Funding and Guarantee Mechanism for the Development of Smart Education (3.72, high). The lowest score is Enhancing the Mechanism for Collaborative Advancement of Smart Education by Home-School-Community (3.31, moderate), indicating that Qinzhou has a good policy and funding guarantee for smart education, but the home-school-community collaborative mechanism is imperfect, and the institutionalization of urban-rural coordinated development needs to be strengthened (Table 7).

Evaluation Items	$\bar{X}$	S.D.	Evaluation Level
Supportive Measures for Local Smart Education Development Policies	3.86	0.57	High

Evaluation Items	$\bar{X}$	S.D.	Evaluation Level
Funding and Guarantee Mechanism for the Development of Smart Education	3.72	0.61	High
Guidance and Service Capabilities of Educational Management Departments in Smart Education	3.65	0.63	High
Dynamic Monitoring and Evaluation Mechanism for the Implementation Effect of Intelligent Education	3.59	0.66	High
The Level of Intelligence in Coordinated Allocation of Urban and Rural Educational Resources	3.45	0.72	Moderate
Assessment and Incentive Mechanism for Rural Smart Education Development	3.42	0.73	Moderate
The Normalized Mechanism for Coordinated Development of Urban and Rural Primary Education	3.38	0.74	Moderate
Enhancing the Mechanism for Collaborative Advancement of Smart Education by Home-School-Community	3.31	0.79	Moderate

Interview Results and Content Analysis

In-depth interviews with 5 education administrators further revealed the practical problems and root causes of urban-rural educational equity promotion in the intelligent transformation of Qinzhou's primary education, and the key conclusions are summarized as follows:

Teacher Team Construction: The digital literacy of rural teachers is uneven, the existing training is a one-size-fits-all model without stratification and classification, and the urban-rural teacher collaboration and mentoring mechanism is not perfect.

Student Development: The digital divide between urban and rural students is prominent, rural students lack digital literacy education and independent learning ability training, and the personalized teaching for rural students is insufficient.

Educational Resource Allocation: The smart hardware allocation between urban and rural areas is unbalanced, the network infrastructure of remote rural schools is weak, the digital resources are mainly oriented to urban students, and the localization adaptation is seriously lacking.

Educational Quality Improvement: The intelligent technology is not deeply integrated with rural teaching practice, the dual-teacher classroom has the problem of formalization, the rural tutoring teachers' role is weakened, and the urban-rural teaching quality gap is difficult to narrow fundamentally.

Policy and Management Optimization: The urban-rural coordinated development mechanism lacks institutionalization, the intelligent education management platform is not perfect, the technical

maintenance system for rural smart education is missing, and the home-school-community collaboration is insufficient.

CONCLUSION AND FUTURE WORK

Conclusion

This study systematically explores the urban-rural educational equity in the intelligent transformation of primary education in Qinzhou, Guangxi, based on a five-dimensional framework (teachers, students, educational resources, educational quality, policy and management). The results indicate that the overall promotion level is moderate (Mean= 3.45, S.D.=0.69), with notable strengths in teacher acceptance of smart education and policy support, while educational resources emerge as the key constraint. Core challenges include unbalanced urban-rural smart hardware allocation, insufficient localization of digital resources, inadequate targeted training for rural teachers, and formalization of intelligent teaching models. The promotion of equity relies on the synergistic effect of multi-dimensional factors, where rural teachers' digital literacy, equitable resource allocation, deep technology-teaching integration, and sound institutional mechanisms play pivotal roles.

Future Work

Despite its findings, this study has limitations: the research scope is limited to Qinzhou, and the cross-sectional design cannot capture dynamic changes in equity promotion. Future research can be expanded in three directions: first, extend the sample to include primary schools in other western coastal cities to verify the generalizability of the conclusions; second, conduct longitudinal tracking to analyze the dynamic evolution of intelligent transformation and equity promotion over time; third, carry out empirical intervention studies on the proposed optimization strategies to test their practical effectiveness and refine operable implementation paths. Additionally, further explore the mediating and moderating effects between key factors to construct a more comprehensive theoretical model for urban-rural educational equity in the intelligent era.

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