International Journal of Innovative Research and Scientific Studies, 8(7) 2025, pages: 720-726

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Application and effectiveness assessment of blended teaching mode in primary and secondary education: A quantitative study in Ganzhou, Jiangxi, China

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Abstract

This study quantitatively examined the implementation and effectiveness of the Blended Teaching Mode (BTM) in primary and secondary schools in Ganzhou, Jiangxi Province, China, within the context of national educational digitalization initiatives. Guided by the Community of Inquiry (CoI) framework and the Technology Acceptance Model (TAM), a cross-sectional survey design was employed. Using stratified random sampling, 235 valid responses were collected from administrators (n=25), teachers (n=60), and students (n=150) across public and private schools in urban, suburban, and rural settings. Data were gathered through validated questionnaires and analyzed using descriptive statistics, correlation analysis, ANOVA, and structural equation modeling (SEM). Results indicated that stakeholder perceptions of BTM effectiveness were generally neutral (mean ≈3.0/5), reflecting a transitional stage of adoption. Student participation (β=0.746, $p<.001$) and teacher development (β=0.268, $p=.005$) emerged as significant predictors of effectiveness, whereas management and assessment mechanisms showed no direct effects. Contextual differences were evident, with private school students demonstrating higher participation, public school students reporting stronger perceptions of technology utility, suburban students showing lower engagement than urban and rural peers, and teachers rating BTM effectiveness more positively than administrators or students. Theoretically, the study extends the application of CoI and TAM to basic education. Practically, it highlights the importance of enhancing teacher digital competence, fostering student engagement, tailoring blended models to local contexts, and employing data-driven evaluation to support sustainable educational digitalization.

Keywords: Education quality, Education reform, Educational Technology, Learning innovation, Student engagement.

DOI: 10.53894/ijirss.v8i7.10529
Funding: This study received no specific financial support.
History: Received: 8 August 2025 / **Revised:** 11 September 2025 / **Accepted:** 15 September 2025 / **Published:** 6 October 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

Against the backdrop of global educational digitalization—accelerated by rapid technological advancements, the emergence of the "digital native" generation, and the catalytic impact of the COVID-19 pandemic—blended teaching has shifted from an optional innovation to a necessary trajectory for educational reform. In China, digitalization in education has been elevated to a national strategic priority, guided by policies such as the Guiding Opinions on Promoting the Construction of New Education Infrastructure and the Opinions on Comprehensively Promoting the Development of 'Internet + Education'. These initiatives aim to integrate digital technologies with primary and secondary education.

As a key region in Jiangxi Province, Ganzhou has actively aligned with these national strategies to advance educational digitalization. However, local schools face several challenges in the implementation of blended teaching. These include unsound management mechanisms, insufficient teacher digital literacy, low levels of student engagement, and outdated assessment systems—factors that significantly constrain the effectiveness of blended teaching in primary and secondary schools.

Blended teaching, defined as the organic integration of digital learning environments with traditional in-person instruction [1], is not merely the combination of "online + offline" formats. Instead, it is a pedagogically grounded strategy designed to optimize personalized learning outcomes. Its development has evolved through three phases: (1) an initial phase (circa 2000), characterized by the supplementation of traditional teaching with online resources; (2) a development phase (2000–2019), marked by systematic advancement guided by theoretical frameworks such as the Community of Inquiry (CoI) [2]; and (3) an empowerment phase (2020–present), during which the COVID-19 pandemic accelerated widespread adoption and maturation.

Globally, research on blended teaching has emphasized theoretical construction and large-scale quantitative effect verification, with a primary focus on higher education. In contrast, domestic research in China has concentrated on practical application and localization, with growing but still limited attention to primary and secondary education. Notably, there remain gaps in the development of context-specific management mechanisms and assessment tools for evaluating blended teaching effectiveness in regions such as Ganzhou.

The management of blended teaching entails the systematic planning, organization, and control of teaching resources, processes, and assessment across online and offline environments. Unlike traditional management models, it requires cross-departmental collaboration, data-driven decision-making, and flexibility to address diverse student needs. Core elements include supportive organizational structures, adequate resource allocation, teacher professional development, and robust quality assurance mechanisms. Yet, in Ganzhou's primary and secondary schools, administrators often lack a deep understanding of blended teaching pedagogy, while traditional organizational structures hinder effective collaboration. Teachers struggle with role adaptation, particularly in areas such as curriculum design, digital resource development, and online instruction. Meanwhile, students—central participants in the process—exhibit uneven autonomous learning abilities and face difficulties integrating online and offline learning experiences. Furthermore, conventional assessment systems, which primarily emphasize academic achievement and classroom performance, fail to capture the multi-dimensional and multi-scenario learning outcomes characteristic of blended teaching. To address these challenges, the present study pursues four key objectives: 1) to investigate the current status and principal problems of blended teaching management in Ganzhou's primary and secondary schools; 2) to identify factors influencing the effectiveness of blended teaching; 3) to construct a scientifically grounded effectiveness assessment indicator system; and 4) to propose targeted management optimization strategies.

Theoretically, this research integrates the CoI framework with the Technology Acceptance Model (TAM) to develop a localized theoretical model adapted to the context of basic education. In doing so, it expands the application of these frameworks beyond higher education and enriches the theoretical foundation of blended teaching management. Practically, the findings may provide valuable decision-making references for education administrators in Ganzhou, contributing to the advancement of educational digitalization, narrowing of the digital divide, and improvement of the overall quality of primary and secondary education.

2. Methods

2.1. Research Design

A quantitative, cross-sectional survey design was employed to examine blended teaching management in primary and secondary schools in Ganzhou City. Questionnaire surveys were used to collect data from administrators, teachers, and

students. The design enabled objective measurement of current practices and identification of factors influencing blended teaching effectiveness.

2.2. Research Hypotheses

Based on the research framework (Figure 1), the following hypotheses were tested:

- *$H_{1:}$ Management mechanism positively affects blended teaching effectiveness.*
- *$H_{2:}$ Teacher development positively affects blended teaching effectiveness.*
- *$H_{3:}$ Student participation positively affects blended teaching effectiveness.*
- *$H_{4:}$ Quality assessment (learning-behavior monitoring, outcome assessment, satisfaction feedback) positively affects blended teaching effectiveness.*

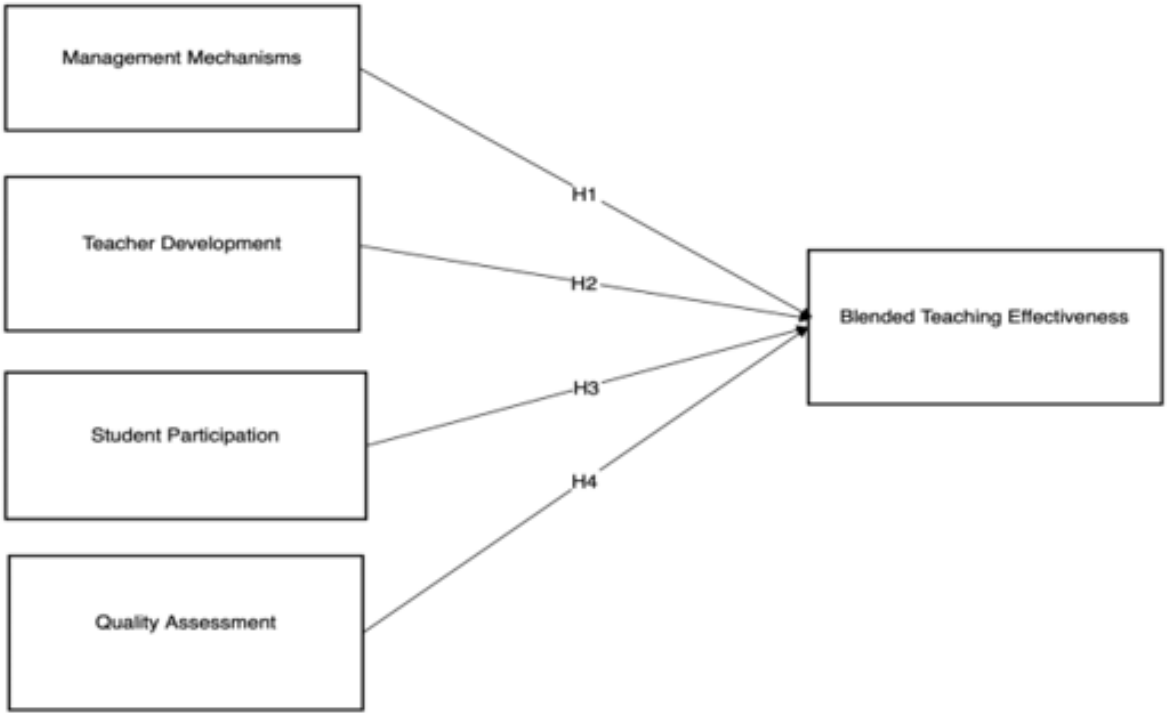

Figure 1.
Research Framework.

2.3. Instruments

Three questionnaires were developed for administrators, teachers, and students. Items were adapted from validated instruments: the Community of Inquiry Survey [3] the Technology Acceptance Model Scale [4], the Student Engagement Scale [5], and the Teacher Digital Competence Scale [6]. All items were measured on a 5-point Likert scale, covering teaching presence, technology acceptance, student engagement, and teacher digital competence.

2.4. Sampling

The population comprised administrators, teachers, and students from approximately 500 schools in Ganzhou City. Stratified random sampling by school type and location ensured representativeness. Sample size requirements for structural equation modeling (SEM) informed the target numbers: 24 administrators, 60 teachers, and 120–240 students.

2.5. Data Collection

Data collection was conducted with approval from the university ethics committee and the Ganzhou City Education Bureau. Questionnaires were distributed and collected onsite in participating schools. A pilot study with five administrators, 10 teachers, and 20 students tested clarity and feasibility, leading to refinement of instruments and procedures.

2.6. Data Analysis

Data were coded and analyzed using SPSS. Descriptive statistics summarized sample characteristics and distributions. Inferential analyses included correlations, multiple regression, SEM, moderation, and ANOVA to test hypotheses and model relationships. Open-ended responses were analyzed using content analysis to complement quantitative findings.

3. Results

3.1. Sample Profile

3.1.1. Questionnaire Response and Validity

A total of 280 questionnaires were distributed across administrators, teachers, and students. Of these, 252 were returned, representing a response rate of 90.0%. After screening for completeness and consistency, 17 were excluded, yielding 235 valid responses (effective response rate: 83.9%). The distribution reflected the hierarchical structure of schools, with students forming the largest group, followed by teachers and administrators, ensuring comprehensive stakeholder representation.

3.1.2. Structural Characteristics

The sample demonstrated balanced representation across education stages, school types, and geographic regions (Table 1). Participants were evenly distributed across primary (33.3%), junior high (34.0%), and senior high (32.7%) levels, ensuring broad coverage of basic education. Private (54.0%) and public (46.0%) schools were proportionately represented, as were rural (32.0%), suburban (35.3%), and urban (32.7%) locations. This distribution supports strong representativeness and external validity.

Table 1.
Sample Structural Characteristics.

Characteristic	Category	Frequency	Percentage (%)
Educational Stage (N = 150)	Primary School	50	33.3
	Junior High School	51	34.0
	Senior High School	49	32.7
School Type (N = 150)	Private School	81	54.0
	Public School	69	46.0
Regional Distribution (N = 150)	Rural	48	32.0
	Suburban	53	35.3
	Urban	49	32.7

3.2. Reliability and Validity Analysis

3.2.1. Reliability Test

Internal consistency was assessed using Cronbach's Alpha (Table 2). Teacher and student questionnaires demonstrated good to acceptable reliability ($\alpha = 0.742$ and 0.703, respectively). For administrators, individual dimensions exceeded 0.900, but the overall scale α was 0.597, suggesting dimensions captured distinct constructs. Item analysis indicated minor scope for refinement (e.g., deletion of IM_Q18 marginally improved α from 0.742 to 0.747).

Table 2.
Reliability Results.

Questionnaire	Alpha Range (Dimensions)	Overall Scale Alpha	Reliability Level
Teacher	0.834 ~ 0.939	0.742	Good
Student	> 0.920	0.703	Acceptable
Administrator	> 0.900	0.597	Low

3.2.2. Validity

Convergent validity was supported by Average Variance Extracted (AVE = 0.622–0.701) and Composite Reliability (CR = 0.859–0.904), exceeding recommended thresholds (AVE > 0.50, CR > 0.70). These results confirm that the measurement model captured intended constructs effectively.

3.3. Descriptive Statistics of Core Variables

Descriptive analysis revealed predominantly neutral to moderate perceptions across stakeholders (Table 3). Mean values ranged from 2.91 to 3.13, clustering around the midpoint of the scale. This suggests a functioning but under-optimized system. Variability was highest for assessment mechanisms (SD = 0.986), indicating divergent administrator views, while teacher development (SD = 0.707) showed greater consensus. These patterns highlight both stability and opportunities for improvement.

Table 3.
Descriptive Statistics of Core Variables.

Variable	Stakeholder	Mean	SD	Interpretation
Assessment Mechanism	Administrators	2.97	0.986	Neutral, internal disagreement
Teacher Development	Teachers	2.91	0.707	Slightly below average
Student Participation	Students	3.00	0.796	Neutral
Professional Reflection	Teachers	2.94	-	Moderate
Instructional Improvement	Teachers	3.02	-	Moderate
Teaching Efficacy	Teachers	3.09	-	Moderately high
Perceived Ease of Use	Students	2.99	-	Moderate
Perceived Usefulness	Students	3.08	-	Moderately high
Performance Management	Administrators	2.92	-	Slightly below average
Teacher Relations	Administrators	3.13	-	Moderately high

3.4. Correlation Analysis

Strong positive correlations were observed across administrator and teacher variables ($r > 0.79$ and $r > 0.74$, respectively; $p < .001$), indicating close interdependence of constructs. For students, moderate to strong correlations emerged (e.g., Student Participation and Perceived Usefulness, $r = 0.513$, $p < .001$). However, very high coefficients (>0.9) suggested risks of multicollinearity and potential conceptual overlap, warranting caution in interpreting subsequent SEM results.

3.5. Structural Equation Modeling (SEM)

3.5.1. Model Fit

The initial model showed poor fit (GFI = 0.692; CFI = 0.835; RMSEA = 0.159). After modifications, the final model reported saturated fit indices (GFI = 1.000; RMSEA = 0.000; CFI and TLI > 1.0), suggesting overfitting. As a result, path analysis results are treated as exploratory.

3.5.2. Path Analysis

Path analysis (Table 4) indicated that Student Participation ($\beta = 0.746$, $p < .001$) and Teacher Development ($\beta = 0.268$, $p = .005$) significantly predicted teaching effectiveness. Management mechanisms ($\beta = –0.021$, $p = .708$) and quality assessment ($\beta = –0.005$, $p = .957$) were non-significant, likely due to multicollinearity effects. These results highlight student engagement and teacher professional development as primary drivers of educational effectiveness, with organizational factors exerting indirect rather than direct influence.

Table 4.
SEM Path Coefficients.

Hypothesis	Path	Standardized Path Coefficient (β)	p-value	Result
H3	Student Participation → Teaching Effectiveness	0.746	0.000	Supported
H2	Teacher Development → Teaching Effectiveness	0.268	0.005	Supported
H4	Quality Assessment → Teaching Effectiveness	-0.005	0.957	Not supported
H1	Management System → Teaching Effectiveness	-0.021	0.708	Not supported

3.6. Difference Analysis

3.6.1. School Types

Private school students reported higher participation ($M = 3.04$ vs. 2.96; $p < .001$), whereas public school students reported higher perceived ease of use, social influence, and usefulness (all $p < .001$) (Table 5). This indicates a divergence between behavioral engagement (higher in private schools) and perceptions of value (higher in public schools).

Table 5.
Perceptual Differences among Students from Different School Types.

Variable	School Type (Mean ± Standard Deviation)		F	p
	Private(n=81)	Public(n=69)		
Student Participation	3.04±0.70	2.96±0.90	3.375	0.000**
Perceived Ease of Use	2.92±0.82	3.07±0.86	3.520	0.000**
Social Influence	2.87±0.85	3.29±0.77	4.080	0.000**
Perceived Usefulness	2.97±0.85	3.20±0.88	3.834	0.000**

Note: * p<0.05 ** p<0.01

3.6.2. Region

Regional differences were limited. The only significant effect was for student participation, which was higher in rural ($M = 3.22$) and urban ($M = 3.10$) contexts compared with suburban ($M = 2.72$; $p = .003$) (Table 6).

Table 6.
Perceptions Across Different Regions.

Variable	Area (Mean ± Standard Deviation)			F	p
	Rural(n=48)	Suburban(n=53)	Urban(n=49)		
Student Participation	3.22±0.76	2.72±0.76	3.10±0.79	5.990	0.003**
Perceived Ease of Use	3.15±0.80	2.82±0.80	3.03±0.90	1.955	0.145
Social Influence	3.28±0.71	2.92±0.80	3.05±0.91	2.432	0.091
Perceived Usefulness	3.05±0.94	2.93±0.75	3.11±0.90	0.562	0.571

Note: * p<0.05 ** p<0.01

3.6.3. Stakeholder Role

Significant group differences emerged for teaching effectiveness (p = .005) (Table 7). Teachers rated effectiveness highest (M = 3.93), followed by administrators (M = 3.26), and students lowest (M = 3.07). This hierarchical pattern underscores role-based evaluative differences.

Table 7.
Perceptual Differences by Stakeholder Role.

Variable	Stakeholder Role (Mean ± Standard Deviation)			F	p
	Administrator	Teacher	Student		
Teaching Effectiveness	3.26±0.53	3.93±0.54	3.07±0.60	2.596	0.005**

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

4. Discussion

The findings of this study highlight several important themes regarding the development of blended teaching in primary and secondary schools in Ganzhou. First, the generally neutral perceptions of administrators, teachers, and students toward blended teaching mechanisms, teacher development, student participation, and teaching effectiveness reflect the transitional stage in which the local education system currently resides. While China has established digital education as a national strategy and Ganzhou has actively responded to these directives, the transformation from policy aspirations and infrastructural expansion to sustainable pedagogical practices is an incremental process. As Cronje [1] argues, blended learning is not a simple combination of online and offline formats but requires carefully designed integration to enhance learning outcomes. In Ganzhou, schools are still adapting: teachers are learning to shift from being transmitters of knowledge to facilitators of learning, students are developing the skills for more autonomous engagement, and administrators are adjusting management structures. This state of flux explains the absence of strongly positive or negative evaluations, as stakeholders are still negotiating how blended teaching fits within established educational practices.

A second key insight is the centrality of "people factors," particularly student participation and teacher development, in driving the effectiveness of blended teaching. Structural equation modeling suggested that these two variables were significant predictors of positive outcomes, whereas management mechanisms and quality assessment did not exert direct effects. This finding aligns with the Community of Inquiry (CoI) framework, which emphasizes cognitive and teaching presence as central to meaningful learning [2]. Students who engage actively in online discussions, collaborative projects, and integrative tasks are more likely to construct cognitive presence, internalize knowledge, and transfer it into practice. Similarly, teachers' ability to design, implement, and adapt blended learning activities directly shapes the quality of teaching presence. The Technology Acceptance Model [4] further supports this interpretation: when teachers perceive blended teaching as useful and manageable, they integrate it more actively into their practice, while students who find platforms accessible and valuable are more motivated to participate. The interplay of perceived usefulness, ease of use, and active engagement underscores why human participation and professional competence, rather than structural or procedural mechanisms, form the backbone of effective blended learning in Ganzhou's schools.

The findings also underscore the contextual variability of blended teaching, shaped by institutional and regional characteristics. Differences between private and public schools highlight a participation–perception divergence: students in private schools tend to be more actively engaged in blended learning, likely due to smaller class sizes and flexible management, while public school students report higher levels of perceived ease of use and usefulness, benefiting from standardized digital platforms and broader alignment with national initiatives. Regional disparities also matter. Rural and urban students reported higher engagement than their suburban counterparts, a pattern that reflects differences in resource distribution. Rural schools have received targeted government support in the form of demonstration and experimental zones for smart education, while urban schools benefit from stronger economic bases and better-qualified teachers. Suburban schools, however, often lack both the dense resources of cities and the compensatory policy support provided to rural areas, creating conditions where student participation may falter.

Role-based differences in perception further highlight how blended teaching is understood and evaluated from different perspectives. Teachers, as direct implementers of blended instruction, rated effectiveness most highly, reflecting their investment of effort and their awareness of instructional improvements. Administrators, although supportive of blended teaching, offered more moderate evaluations, shaped by their broader responsibility for system-wide coordination and policy compliance. Students were the least positive, reflecting their direct experiences of uneven instructional quality, varied levels of digital literacy, and the challenges of transitioning to more autonomous forms of learning. These divergent perspectives underscore the importance of multi-stakeholder approaches in designing, managing, and evaluating blended teaching reforms.

Overall, these interpretations suggest that blended teaching in Ganzhou's primary and secondary schools is in a transitional phase where infrastructural readiness has been achieved, but pedagogical integration is still developing. Effectiveness depends less on structural mechanisms than on the agency of teachers and students, whose engagement and competence are shaped by institutional contexts and resource environments. Theoretical insights from the CoI framework and TAM help explain why teaching presence, cognitive presence, and technology acceptance are critical to achieving successful outcomes. In practical terms, this means that strategies for improving blended teaching should focus on deepening student engagement, investing in teacher professional development, and tailoring interventions to local contexts rather than relying solely on administrative structures or assessment reforms.

5. Conclusion

This study systematically examined the status and effectiveness of blended teaching in primary and secondary schools in Ganzhou, Jiangxi Province, through a quantitative investigation integrating the Community of Inquiry (CoI) framework and the Technology Acceptance Model (TAM). Based on 235 valid responses from administrators, teachers, and students, the findings revealed that stakeholders generally hold neutral perceptions of blended teaching, reflecting a transitional stage in which policy-driven digital infrastructure has been established but pedagogical integration is still evolving. The analysis further identified student participation and teacher development as the primary drivers of blended teaching effectiveness, while management mechanisms and quality assessment showed no direct effects, suggesting their influence may operate indirectly through mediating variables.

The study makes both theoretical and practical contributions. Theoretically, it extends the application of the CoI framework to basic education and enriches blended teaching management research by integrating it with TAM, thereby offering a more comprehensive effectiveness assessment system. Practically, the findings provide actionable insights for educational administrators, emphasizing the need to strengthen teacher professional development and foster active student engagement as levers for improving blended teaching outcomes. The results also highlight contextual disparities across school types, regions, and stakeholder groups, underscoring the importance of tailoring management strategies to local conditions. Collectively, these insights contribute to advancing digitalization in primary and secondary education, reducing regional digital divides, and promoting equity and quality in educational development.

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