Research on Curriculum Development and Management Mechanisms for Qingshen Bamboo Weaving in the Context of Industry-Education Integration

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Abstract

This study applies industrial value chain and educational management theories as a value chain–oriented theoretical lens to systematically examine the determinants of curriculum design and development in traditional craft vocational education, emphasizing optimization strategies within industry–education integration frameworks.Using a mixed-methods research, we conducted questionnaire surveys with 380 stakeholders (350 valid responses) and employed multiple linear regression to evaluate how educational management components influence instructional effectiveness in the case of the Qingshen bamboo weaving curriculum.Empirical findings demonstrate that market demand alignment ($\beta=0.356$, $p<0.001$) exerts the greatest influence on curriculum development and teaching effectiveness, followed by technological empowerment ($\beta=0.349$, $p<0.001$), experiential curriculum design ($\beta=0.291$, $p<0.001$), and inheritors' collaborative teaching ability ($\beta=0.286$, $p<0.001$), with the overall model explaining 47.2% of variance. The study underscores that integrating value chain perspectives into curriculum development effectively connects the educational continuum from “skill transmission—competency development—professional requirements” while promoting systematic optimization of curriculum governance mechanisms and enhancing talent development quality in traditional craft vocational education. Based on empirical analysis, we propose a demand-driven “four-dimensional collaborative curriculum development model” that achieves curriculum value enhancement while optimizing educational resources and multi-stakeholder collaborative governance, providing theoretical foundations and practical guidance for curriculum reform, pedagogical innovation, and educational management modernization in traditional craft vocational education.

Keywords: Qingshen bamboo weaving, traditional crafts, curriculum development, teaching innovation, educational management, industry-education integration

1. Introduction

Traditional craft vocational education faces unprecedented challenges in curriculum development and pedagogical innovation amid the dual imperatives of modernizing vocational training and safeguarding Chinese cultural heritage. The core challenge lies in achieving scaled, standardized, and systematic talent cultivation within educational systems while maintaining cultural authenticity in traditional crafts. Sichuan Qingshen bamboo weaving, designated as a national-level item of intangible cultural heritage, embodies over two millennia of craft evolution and cultural depth. Its comprehensive system encompasses bamboo selection, splitting techniques, weaving methods, design aesthetics, and cultural symbolism, thereby reflecting profound cultural values while demonstrating significant applied and commercial potential. However, within modern educational frameworks, traditional master-apprentice transmission models present structural limitations, including restricted dissemination, low instructional efficiency, and misalignment with contemporary educational paradigms, which constrain their ability to meet vocational education demands for large-scale, high-quality talent development.

Contemporary educational contexts present multiple challenges for Qingshen bamboo weaving curriculum development: first, curriculum systems are often fragmented, with disconnected content lacking systematic

alignment with professional requirements; second, limited pedagogical approaches predominantly relying on experiential and imitative learning that inadequately stimulate learner agency and creativity; third, insufficient educational resource is insufficient, with shortages of specialized faculty and deficiencies in teaching infrastructure and technological platforms. While traditional apprenticeship ensures authentic skill transmission, its experience-based approach cannot support current vocational education requirements for quality assurance, industry alignment, and educational equity.

Modern vocational education, as a primary pathway for skilled workforce development, offers new platforms and opportunities for traditional craft education innovation and cultural transmission. Through scientifically designed development and educational management, vocational education can promote systematic skill inheritance while enabling deep integration with social and industrial needs, creating synergistic mechanisms linking cultural, educational, and social value. Particularly within industry-education integration contexts, incorporating industrial value chain thinking and educational management theory into curriculum development processes represents both a practical necessity for high-quality vocational education development and an inevitable pathway for sustainable traditional craft preservation and innovation. Therefore, this study introduces management elements within an education-centered framework, utilizing value chain analysis to identify key educational management factors in curriculum development and construct an educational continuum encompassing "resource optimization—curriculum value enhancement—collaborative education," aiming to provide theoretical support and practical guidance for curriculum reform, pedagogical innovation, and educational management modernization in traditional craft vocational education.

1.1 Research Questions

1) Which educational management factors influence the effectiveness of Qingshen bamboo weaving curriculum development?

2) What are the relative contributions of these factors to enhancing educational value?

3) How can an effective industry-education collaborative model be constructed to optimize curriculum governance?

1.2 Research Objectives

1) To identify the critical management factors that enhance educational value in the curriculum development of traditional bamboo weaving;

2) To analyze the mechanisms and relative contributions of these factors to instructional effectiveness

3) To construct a systematic framework for curriculum management and collaborative education in traditional crafts.

1.3 Research Framework

This study integrates resource-based theory, value chain management theory, and stakeholder theory to construct an educational management analysis framework for traditional craft curriculum development. Resource-based theory (Barney, 1991) elucidates how inheritors' collaborative teaching ability and technological empowerment enhance curriculum competitive advantage through educational resource optimization. Value chain management theory (Porter, 1985) emphasizes market demand alignment and pedagogical transformation roles in educational value chain reconfiguration. Stakeholder theory (Freeman, 1984) provides the oretical foundations for collaborative education mechanisms involving multiple actors, including government agencies, educational institutions, enterprises, master craftspeople, and learners.

Building on these foundations, this study proposes a "resource—curriculum value—pedagogical governance" collaborative framework that achieves curriculum value chain optimization through effective integration of educational resources, ensures value realization via multi-stakeholder collaborative governance mechanisms, and ultimately promotes sustainable development in traditional craft vocational education. (Figure 1)

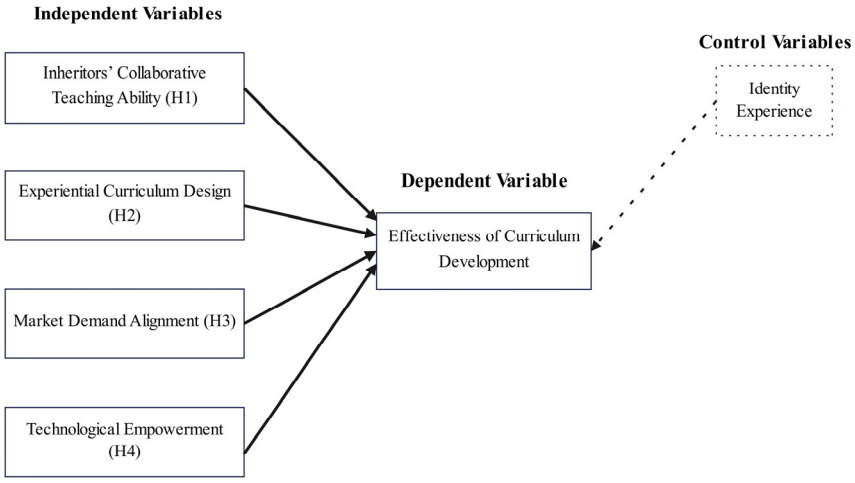

Figure 1. Research Framework

1.4 Research Hypotheses

H1: Inheritors' collaborative teaching ability has a significant positive effect on the effectiveness of curriculum development.

H2: Experiential curriculum design has a significant positive effect on the effectiveness of curriculum development.

H3: Market demand alignment has a significant positive effect on the effectiveness of curriculum development.

H4: Technological empowerment has a significant positive effect on the effectiveness of curriculum development.

2. Literature Review

2.1 Theoretical Foundations and Curriculum Management Challenges in Traditional Craft Education

Current scholarship highlights that a central challenge in traditional craft education lies in transforming cultural resources into educational assets by systematically embedding artisanal skills and cultural content within contemporary curriculum systems (Liu & Wang, 2025). This perspective aligns with UNESCO's Convention for the Safeguarding of the Intangible Cultural Heritage, which highlights the pivotal role of education in cultural preservation and transmission.

Theoretically, Porter's (1985) value chain framework offers a systematic tool for analyzing traditional craft education. Liu et al. (2023) conceptualize the educational process as a curricular "value chain," whereby optimizing individual components enhances curriculum effectiveness and social relevance. Barney's (1991) resource-based view further emphasizes the distinctiveness and strategic value of educational resources. In their study of bamboo weaving, Sun and Liu (2022) argue that tacit knowledge and cultural accumulation constitute core resources for educational competitiveness, yet converting these resources into explicit curricular content remains a pressing management challenge.

Empirical studies also expose persistent difficulties. Song et al. (2023) reveal that the master-apprentice model is inefficient and limited in scope, failing to meet the scale required for vocational education. Zhang (2024) finds that Qingshen bamboo weaving education suffers from an aging inheritor population and insufficient youth participation, producing a misalignment between curricular provision and labor market demands. Similarly, Shen et al. (2024) contend that without organizational innovation and effective governance, traditional craft education cannot shift from experience-based transmission to integration within standardized pedagogical systems.

Taken together, existing research offers useful insights into value chain optimization and resource integration. However, systematic analytical frameworks and robust quantitative approaches remain underdeveloped, providing the entry point for this study.

2.2 Industry-Education Integration Collaborative Mechanisms and Curriculum Development Theory

Industry-education integration represents the foundation of contemporary vocational education systems, fundamentally addressing educational supply-demand alignment to enhance talent development quality (Yi et al., 2023). Freeman's (1984) stakeholder theory provides theoretical underpinning for this process, emphasizing multi-stakeholder collaboration in educational governance. Chen and Yu (2023) demonstrate that stakeholder cooperation in cultural and tourism education significantly enhances both educational outcomes and industrial performance. Germany's dual education system exemplifies this approach, with Kang (2024) identifying government support, industry participation, and school-enterprise partnerships as critical success factors, offering transferable insights for traditional craft education governance.

Curriculum development, as a core educational management function, directly impacts educational objective achievement. Hamadi et al. (2024) advocate for curriculum development that balances educational goals, cultural values, and social needs. Yu (2025) proposes that value chain-informed curriculum development should encompass not only skill instruction but also cultural preservation and innovation capacity building. Additionally, Song et al. (2023) highlight substantial tacit knowledge embedded traditional craft education requiring systematic transformation through knowledge management. Nonaka and Takeuchi's (1995) SECI model provides methodological guidance, with Songkram and Chootongchai (2020) validating its educational innovation effectiveness.

Experiential learning theory offers additional frameworks for traditional craft education. Kolb's (1984) “learning by doing” philosophy closely corresponds craft transmission characteristics. Gao (2025) demonstrates that visual educational strategies enhance learner immersion and practical competencies in traditional craft courses. Research by Zhao (2025) and Ho and Shih (2023) further establishes project-based learning's (PBL) significant impact on student innovation and critical thinking development. Chen Zhengkai and Xu Ting's (2025) empirical study in ceramic design validates the “PBL+PAD” (Presentation-Assimilation-Discussion) model's effectiveness in improving student engagement and curriculum adaptation.

While current research provides extensive theoretical and practical foundations for industry-education integration and curriculum development, systematic analytical frameworks specifically addressing traditional craft education remain underdeveloped. This study builds upon existing knowledge to explore applications of the educational value chain and collaborative governance

2.3 Technology-Enabled Pedagogical Innovation and Educational Value Chain Transformation

Rapid information technology advancement creates new opportunities for traditional craft education. Zhang et al. (2023) demonstrate that virtual reality (VR) systems effectively present bamboo weaving's cultural context and operational processes, providing immersive learning experiences. Similarly, Wu et al. (2023) employed eye-tracking experiments to investigate aesthetic preferences for bamboo weaving patterns, demonstrating how perceptual analysis can inform curriculum design by enhancing students’ cultural resonance and aesthetic awareness in traditional craft education. From a data analytics perspective, Jiang (2022) shows that technological tools optimize STEM educational activities, enhancing curriculum design rigor and fostering student innovation.

In design education, Sun and Liu (2022) identify limited design-manufacturing integration as a key constraint on traditional craft education innovation. Shinohara and Chan's (2024) computational design methodology expands bamboo weaving applications across educational and architectural curricula, facilitating interdisciplinary skill transfer. Concurrently, Gao et al. (2024) establish that perceptual assessment and user analysis enable traditional craft pattern design to generate cultural resonance among young learners, supporting cultural and aesthetic education integration in curriculum development.

In summary, technological enablement plays an important role in enhancing the efficiency of traditional craft education and broadening its developmental pathways. Yet existing research has not sufficiently addressed how cultural resources can be systematically transformed into educational assets through a comprehensive framework. To bridge this gap, the present study introduces the value chain model as its conceptual foundation. Originally developed by Porter (1985) in the field of strategic management, the value chain framework conceptualizes value creation as a sequence of interrelated activities, each incrementally contributing to overall outcomes. Adapted to the context of traditional craft education, it highlights how intangible cultural heritage can be embedded into educational systems through stages such as resource identification, curriculum development, pedagogical design, skill transfer, and integration with industry demand. This definition not only clarifies the theoretical lens adopted in this study but also provides a practical basis for analyzing how educational management and technological innovation can jointly

promote the systematic revitalization of traditional crafts.

3. Research Method

This study employs a mixed-methods approach, integrating quantitative survey research with qualitative in-depth interviews to comprehensively examine key educational management factors shaping Qingshen bamboo weaving curriculum development and teaching effectiveness. Following Creswell and Plano Clark's (2017) mixed-methods design framework, the research emphasizes complementary integration of quantitative breadth and qualitative depth to enhance findings' reliability and explanatory power. Specifically, we implement a cross-sectional survey design collecting large-sample data through questionnaires, supplemented by in-depth interviews for contextual qualitative insights. This explanatory sequential design aligns with mainstream educational research paradigms: quantitative analysis identifies key educational management factors and their relative contributions, while qualitative analysis illuminates underlying pedagogical logic and governance mechanisms.

3.1 Participants and Sampling

Research participants include faculty, students, and practitioners from Sichuan Province vocational institutions offering bamboo weaving curricula, representing primary stakeholders within the Qingshen bamboo weaving educational ecosystem. To ensure representative and diverse sampling, we employed stratified sampling across five stakeholder groups: vocational institution faculty, students, master craftspeople, industry professionals, and educational administrators, yielding 350 valid respondents distributed as follows: faculty (n=137, 39.1%), students (n=69, 19.7%), master craftspeople (n=52, 14.9%), industry professionals (n=53, 15.1%), and educational administrators (n=39, 11.1%).The sample size satisfies Hair et al.'s (2019) minimum requirements for multiple regression analysis, thereby ensuring statistical inferences.

3.2 Instrumentation

Questionnaire development followed DeVellis's (2016) scale construction principles, utilizing five-point Likert scales across three sections: demographic information capturing participant identity, experience, and engagement levels; core measurement encompassing four educational management dimensions through 20 items—master craftsperson collaborative teaching capacity, experiential pedagogical design, curriculum-market alignment, and technological enablement; and educational effectiveness assessment through six items measuring student learning outcomes, innovation capacity development, cultural identity enhancement, and employment preparation. Content validity was established through expert review by vocational education and traditional craft specialists. Reliability and validity testing follows Hair et al.'s (2019) statistical procedures, employing Cronbach’s α for internal consistency and KMO values with Bartlett's sphericity tests of sphericity to assess factor analysis suitability.

3.3 Data Collection Procedures

Data collection proceeded through three sequential stages. Stage one involved pilot testing with small samples prior to full implementation, incorporating feedback to refine item wording and structural elements. Stage two comprised formal survey administration through combined online and offline distribution methods ensuring broad stakeholder participation. Stage three entailed supplementary interviews with key informants including provincial-level master craftspeople, senior faculty, industry leaders, and educational administrators, utilizing semi-structured interviews focused on the four educational management dimensions to illuminate governance mechanisms underlying quantitative findings.

3.4 Data Analysis Strategy

Analysis integrates quantitative and qualitative approaches. Quantitative analysis employs SPSS for statistical processing, beginning with descriptive statistics characterizing sample demographics, followed by correlation analysis examining inter-variable relationships, and multiple linear regression exploring four educational management dimensions' impact on educational effectiveness while controlling for demographic variables. Statistical inference validity requires testing assumptions of normality, linearity, homoscedasticity, multicollinearity, and independence throughout analysis procedures. Qualitative analysis applies Braun and Clarke's (2006) thematic analysis methodology through six systematic steps: data familiarization, initial coding generation, theme identification, theme review, theme definition, and results synthesis, extracting governance-related themes for integration with quantitative findings. Through mixed-methods triangulation, this study enhances conclusions' educational explanatory power and practical applicability.

4. Research Results

4.1 Sample Characteristics Analysis

The study distributed 380 questionnaires, achieving a 92% response rate with 350 valid responses collected. Sample distribution (Table 1) demonstrates considerable diversity across participant categories. Vocational institution faculty comprised the largest group (39.1%), aligning with the study's educational practice focus. Participation experience ranged from direct teaching involvement to minimal familiarity, providing multi-perspective analytical depth. Notably, 34% of respondents identified insufficient faculty resources as the primary challenge, followed by inadequate industry partnerships (22.6%) and traditional teaching approaches (20%), underscoring the critical need for faculty development and curricular innovation in bamboo weaving education.

Table 1. Sample Demographic Characteristics Distribution (N=350)

Characteristic Category	Classification	Number	Percentage (%)
Identity Distribution	Professional Teachers	137	39.1
	Students	69	19.7
	Bamboo Weaving Craftspersons	52	14.9
	Enterprise Personnel	53	15.1
	Educational Administrators	39	11.1
Participation Experience	Directly Participated in Bamboo Weaving Teaching	96	27.4
	Observed Related Courses	114	32.6
	Understood but No Direct Contact	88	25.1
	Completely Unfamiliar	52	14.9
Most Urgent Problems to Solve	Insufficient Faculty	119	34.0
	Inadequate Industry Alignment	79	22.6
	Outdated Teaching Methods	70	20.0
	Other Issues	82	23.4

4.2 Reliability and Validity Verification

Exploratory factor analysis confirmed data suitability for factor extraction, with KMO=0.925 and significant Bartlett's sphericity test (χ^2=10,242.690, df=325, $p<0.001$). Principal component analysis extracted five factors with eigenvalues >1.0, explaining 85.409% of cumulative variance, exceeding conventional thresholds. All items demonstrated factor loadings >0.8 with cross-loadings <0.4, indicating strong discriminant validity (Table 2). Reliability analysis revealed Cronbach's α coefficients ranging from 0.954 to 0.965 across dimensions, with overall scale reliability α=0.896, substantially exceeding the 0.7 criterion (Table 3). These results confirm the instrument's internal consistency and measurement validity. Scale structure alignment with theoretical dimensions validates its appropriateness for bamboo weaving curriculum development assessment.

Table 2. Exploratory Factor Analysis Results

Item	Factor 1	Factor2	Factor3	Factor4	Factor5	Indicator Description
	Expected Teaching Effectiveness	Inheritors' collaborative teaching ability	Technological empowerment	Market demand alignment	Experiential curriculum design	-
E21	.847					Effectively enhance professional skills
E22	.842					Strengthen cultural identity
E23	.839					Cultivate innovative design ability
E24	.867					Improve employment competitiveness
E25	.830					Increase learning enthusiasm
E26	.861					Improve teaching quality
A1		.910				Craftsperson technique explanation ability
A2		.926				Craftsperson demonstration ability
A3		.915				Craftsperson individualized teaching ability
A4		.935				Craftsperson educational philosophy
A5		.902				Craftsperson modern Alignment ability
D16			.893			Digital display tool effectiveness
D17			.930			Design software auxiliary value
D18			.892			Online platform interactive role
D19			.924			Virtual simulation technology value
D20			.898			Technology-craft Alignment trend
C11				.879		Course alignment with industry needs
C12				.912		Enterprise expert participation guidance
C13				.892		Work commercialization standards
C14				.916		Skills meet employment requirements
C15				.891		School-enterprise cooperation training base
B6					.898	Progressive skill experience
B7					.920	Complete production process experience
B8					.908	Reflection and summary sessions
B9					.911	Active exploration and innovation
B10					.907	Theory-practice Alignment
Eigenvalue	8.340	4.347	4.139	3.800	1.580	>1.0
Variance Explained (%)	32.078	16.719	15.921	14.614	6.078	Total 85.409%
Loading Range	0.830-0.867	0.902 -0.935	0.892 -0.930	0.879- 0.916	0.898- 0.920	All>0.8

Table 3. Cronbach's α Coefficient Results

Dimension	Number of Items	Cronbach's α
Inheritors'collaborative teaching ability	5	0.960
Technological empowerment	5	0.956
Market demand alignment	5	0.954
Experiential curriculum design	5	0.957
Expected Teaching Effectiveness	6	0.965
Overall Scale	26	0.896

4.3 Descriptive Statistics and Correlation Analysis

Descriptive analysis (Table 4) reveals highest mean scores for market demand alignment (M=3.039), followed by inheritors' collaborative teaching ability (M=2.987) and experiential curriculum design (M=2.965), indicating broad recognition of these factors' curricular importance. Technological empowerment scored relatively lower (M=2.928), suggesting unrealized application potential.

Correlation analysis (Table 5) demonstrates significant positive relationships between anticipated educational outcomes and all four predictors, with market demand alignment showing strongest association ($r=0.421$, $p<0.01$), followed by technological empowerment ($r=0.379$), experiential curriculum design ($r=0.337$), and inheritors' collaborative teaching ability ($r=0.306$). Generally low inter-variable correlations confirm dimensional independence. Results indicate bamboo weaving curriculum effectiveness depends on synergistic factor interactions, with market demand alignment perceived as most critical.

Table 4. Variable Descriptive Statistics Results

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Expected Teaching Effectiveness	350	2.0	4.0	2.987	.6633
Inheritors' Collaborative Teaching Ability	350	2.0	4.0	2.965	.6423
Experiential Curriculum Design	350	2.0	4.0	3.039	.6322
Market Demand Alignment	350	2.0	4.0	2.928	.6612
Technological Empowerment	350	1.2	4.0	2.462	.4942

Table 5. Pearson Correlation Analysis Results

Pearson Correlation	Expected Teaching Effectiveness	Inheritors' Collaborative Teaching Ability	Experiential Curriculum Design	Market Demand Alignment	Technological Empowerment	Identity	Experience
Expected Teaching Effectiveness	1.000						
Inheritors' Collaborative Teaching Ability	.306**	1.000					
Experiential Curriculum Design	.337**	-.003	1.000				
Market Demand Alignment	.421**	.063	.084	1.000			
Technological Empowerment	.379**	.009	.037	.055	1.000		
Identity	.066	-.052	.039	.061	.000	1.000	
Experience	.024	-.033	.063	.019	-.073	-.035	1.000

Note: ** indicates significance at the 0.01 level

4.4 Multiple Linear Regression Analysis Results

Table 6. Linear Regression Analysis Results

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Tolerance	VIF	Durbin-Watson	R^2	Adjusted R^2	F
	B	Std. Error	Beta								
Constant	-0.528	0.178		-2.969	0.003			2.118	0.472	0.463	51.103
Inheritors' Collaborative Teaching Ability	0.213	0.029	0.286	7.250	0.000	0.992	1.008				
Experiential Curriculum Design	0.224	0.030	0.291	7.379	0.000	0.987	1.014				
Market Demand Alignment	0.278	0.031	0.356	8.980	0.000	0.982	1.018				
Technological Empowerment	0.261	0.029	0.349	8.857	0.000	0.990	1.010				
Identity	0.017	0.014	0.050	1.256	0.210	0.990	1.010				
Experience	0.017	0.019	0.035	0.897	0.370	0.987	1.013				

Dependent variable: Expected_Teaching_Effectiveness

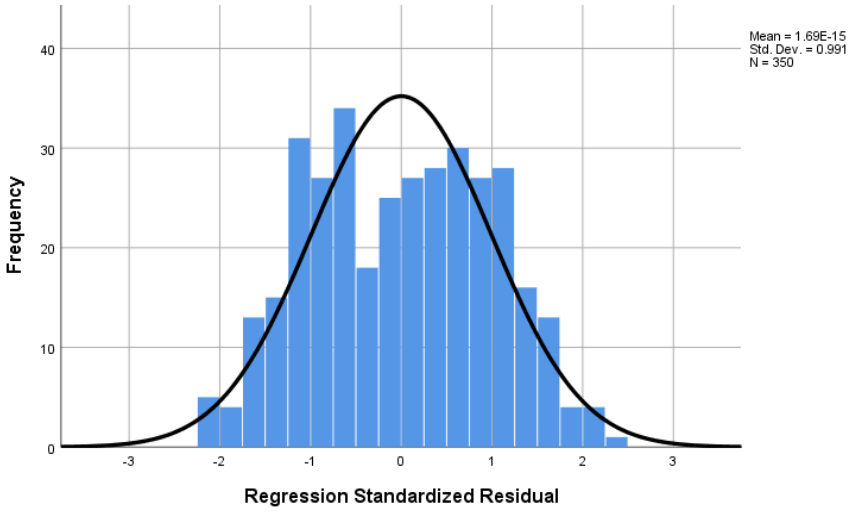

Figure 2. Histogram of Standardized Residuals

Regression analysis (Table 6) demonstrates satisfactory model fit (R^2=0.472, adjusted R^2=0.463), explaining 47.2% of outcome variance. The model achieved statistical significance (F=51.103, p<0.001), with Durbin-Watson statistic=2.118 indicating absence of autocorrelation, satisfying regression assumptions. All four predictors significantly and positively influenced anticipated educational outcomes: market demand alignment demonstrated strongest impact (β=0.356, p<0.001), followed by technological empowerment (β=0.349, p<0.001), experiential curriculum design (β=0.291, p<0.001), and inheritors' collaborative teaching ability (β=0.286, p<0.001). Control variables (participant identity and experience) showed no significant effects, indicating consistent factor perceptions across stakeholder

groups. Collinearity diagnostics revealed VIF values approaching 1.0, eliminating multicollinearity concerns. Residual analysis (Figures 1-2) confirmed normal distribution and robust model performance. Findings establish that bamboo weaving curriculum effectiveness significantly depends on market demand alignment, technological empowerment, experiential curriculum design, and inheritors' collaborative teaching ability.

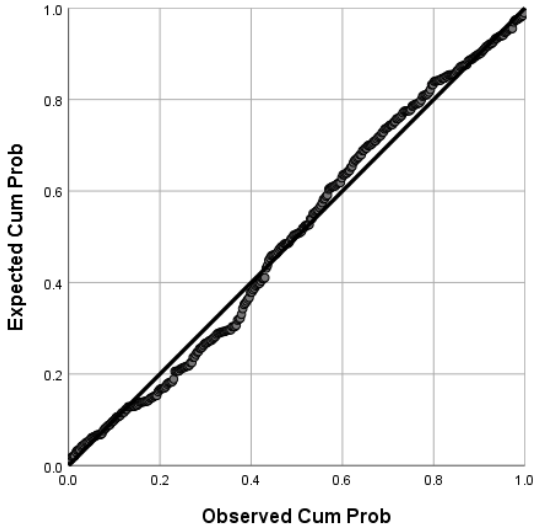

Figure 3. Normal P-P Plot of Regression Standardized Residuals

4.5 Qualitative Interview Analysis

To illuminate mechanisms underlying quantitative findings, this study conducted semi-structured interviews with 12 key informants. Thematic analysis identified four core themes corresponding to the quantitative study's four influence factors, providing rich contextual interpretation of statistical results.

Theme 1: Market Demand Alignment as Primary Driver

Interview findings strongly corroborate quantitative results identifying market demand alignment as the dominant influence factor. Enterprise expert E1 emphasized: “Students who lack market awareness struggle with employment despite mastering traditional techniques. We need multidisciplinary professionals who understand both traditional crafts and contemporary design.” Master craftsperson T2 concurred: “Contemporary bamboo weaving must transcend historical replication to address modern lifestyle needs through cultural products and household items—this creates viable pathways forward.”

Faculty member I1 explained market demand alignment's pedagogical significance: “When curriculum projects derive from authentic enterprise commissions, student engagement intensifies dramatically. Students recognize their work's market value, providing clear learning objectives and intrinsic motivation.” Administrator M1 elaborated: “Market demand alignment transcends employment concerns—it represents essential modernization for traditional crafts. Only through deep industrial partnerships can traditional arts establish sustainable contemporary relevance.”

Theme 2: Technological Empowerment's Paradoxical Nature

Regarding technological empowerment's second-rank positioning, interviews revealed complex application dynamics. Master craftsperson T1 noted: “Digital tools offer genuine benefits—computer pattern design, video technique documentation—yet bamboo weaving's essence remains manual dexterity that technology cannot supplant." Industry expert E2 observed: "Technology's value lies in appropriate application. 3D design software accelerates students' spatial understanding, but authentic weaving demands handcraft mastery.”

Faculty member I2 described successful technological empowerment integration: “VR technology enables students to 'enter' bamboo groves, experiencing growth patterns and selection criteria through immersive engagement far exceeding traditional lectures. However, technology serves as tool, not replacement.” Master craftsperson T3 emphasized balance: “Digital natives respond to technological innovation, attracting them to bamboo weaving study, but ultimately must return to traditional handcraft foundations. Technology augments rather than substitutes.”

Theme 3: Experiential Curriculum Design's Cultural Transmission Function

Interviews illuminated cultural dimensions underlying experiential curriculum design's importance. Master craftsperson T4 stressed: “Bamboo weaving encompasses technology and culture equally. Only through hands-on engagement do students experience bamboo's resilience, weaving rhythms, and ancestral wisdom.” Faculty member I3 analyzed pedagogically: “Traditional lecture formats cannot convey bamboo weaving's essence. Students must develop understanding through iterative practice, learning from errors and achieving success-based satisfaction.”

Industry expert E3 supported experiential approaches pragmatically: “Recruitment prioritizes operational competency and material comprehension—capabilities requiring extensive practical development.” Administrator M2 synthesized: “Experiential curriculum design aligns with traditional craft education's inherent principles while satisfying modern vocational education's practical skill emphasis—representing optimal traditional-contemporary integration.”

Theme 4: Inheritors' Collaborative Teaching Ability Adaptation Challenges

Despite ranking fourth quantitatively, interviews revealed significant adaptation challenges for inheritors in contemporary educational contexts. Master craftsperson T1 acknowledged: “Our generation mastered individual mentorship—one-on-one, hands-on instruction. Confronting multiple students while preparing lesson plans and presentations creates genuine pressure.”

Faculty member I1 observed: “nheritors possess invaluable practical experience and cultural depth but require pedagogical methodology and classroom management development. Optimal approaches involve craftsperson-educator partnerships leveraging complementary strengths.” Industry expert E1 concluded: “Inheritors represent irreplaceable authenticity and cultural continuity. Contemporary education requires them to transmit traditional wisdom through modern pedagogical frameworks.”

Administrator M1 proposed solutions: “We're developing 'dual-instructor' models where inheritors focus on skill transmission and cultural heritage while professional educators handle instructional design and classroom management, optimizing respective capabilities.”

5. Discussion

5.1 The Core Role of Market Demand Alignment and Its Theoretical Significance

Survey and regression results demonstrate that market demand alignment is the most influential factor in shaping the effectiveness of Qingshen bamboo weaving curriculum development ($\beta = 0.356$, $p < 0.001$). This suggests that effectiveness depends not only on the instructional quality of teachers and inheritors but also on whether curricula remain consistent with contemporary industry standards and societal needs. Detached from industrial realities, even well-designed courses risk low student motivation and limited applicability. In contrast, alignment with real market demands fosters clearer linkages between skill acquisition and future career development, thereby strengthening both engagement and learning outcomes.

This conclusion resonates with the central logic of value chain theory. Porter (1985) argued that competitive advantage arises from the integration and optimization of value activities. In the field of craft education, market demand alignment functions as a value chain integrator that links curriculum design, inheritor expertise, pedagogical approaches, and industry practice in order to maximize educational value. Fu and Choatchamrat (2024) similarly observed in their study of Jinghe Opera education that sustainable transmission requires not only skill teaching but also institutional and community-based partnerships. Recent literature, however, reminds us that market alignment is not without risk. Immonen (2025) shows that heritage education often reflects political and cultural identity priorities, which means economic efficiency cannot always be the overriding concern. Valencia Arnica (2023) also notes that heritage curricula designed solely with reference to market needs may erode cultural depth, producing outcomes that privilege utility over meaning.

Interview findings add contextual richness. Industry experts stressed that real enterprise orders or market-oriented projects greatly improved student enthusiasm because learners recognized the tangible value of their work. Teachers highlighted that incorporating industry cases and enterprise standards into classroom projects promoted practical orientation and clarified student goals. Inheritors pointed out that if bamboo weaving remains locked in purely traditional forms and fails to adapt to modern consumers’ needs, its relevance in education will inevitably decline. Educational administrators regarded market alignment as essential not only for improving employment prospects but also for ensuring the long-term modernization of traditional crafts. Considered together, these insights indicate that

market demand alignment cannot be treated as a peripheral influence. It is instead a central mechanism that enables traditional craft education to move toward systematic development,provided responsiveness is balanced with cultural authenticity

5.2 The Important Role of Technological Empowerment and Implementation Pathways

Regression analysis places technological empowerment immediately after market demand alignment in its effect on curriculum effectiveness ($\beta = 0.349$, $p < 0.001$). This finding reflects the broader trend of educational digitalization, where technology is no longer viewed as a marginal support but as a driver that directly shapes both pedagogical outcomes and industrial transformation. Teachers and students alike reported that digital tools improved efficiency and quality, and this perception reinforces the idea that craft education must integrate technological innovation to overcome the limitations of small-scale, workshop-style transmission.

From a theoretical standpoint, these results are consistent with resource integration theory, which maintains that technology alone does not guarantee advantage unless it is embedded within broader systems of skills, objectives, and institutional needs. Prior studies have demonstrated that digital platforms can bridge the gap between traditional arts and modern education, allowing skills to be disseminated beyond the confines of face-to-face instruction (Cai et al., 2025). More recent contributions offer a nuanced perspective. Anwar (2025) reports that metaverse and XR applications enhance learner immersion but introduce issues of cost and unequal access. Guo (2025) shows that bichronous models combining synchronous and asynchronous activities yield motivational gains that surpass those of purely experiential approaches. At the same time, Suiçmez (2025) highlights that artificial intelligence applications in museums can distort cultural meaning due to algorithmic bias, raising concerns about authenticity and representation.

Interview materials reinforce this ambivalence. Teachers and enterprise managers acknowledged the benefits of VR and 3D modeling for improving classroom interaction and industrial applicability. Inheritors expressed apprehension that reliance on digital systems could devalue manual practice and obscure cultural meaning. Thus, technology is indispensable for reach and efficiency, but its adoption must be carefully managed to preserve authenticity in bamboo weaving education, technological empowerment should be approached as a managed resource, calibrated to achieve a balance between cultural fidelity and industrial adaptability.

5.3 Theoretical Verification and Practical Value of Experiential Curriculum Design

Empirical evidence confirms that experiential curriculum design has a statistically significant influence on bamboo weaving curriculum effectiveness ($\beta = 0.291$, $p < 0.001$). Although its effect is somewhat lower than market demand alignment and technological empowerment, it performs a critical bridging function in the educational value chain. Because bamboo weaving depends on tacit, embodied knowledge, students cannot master it through lectures alone but must engage in repeated practice that cultivates sensory understanding. Survey data indicate that project-based learning and complete production experiences substantially increase motivation and ensure that learners connect practice with cultural meaning.

Theoretical models corroborate these observations. Kolb's (1984) experiential learning cycle provides a strong explanatory framework in which students move through experience, reflection, conceptualization, and experimentation. Building on this perspective, Yan and Li (2023) show that experiential approaches in heritage education foster students' innovation capabilities and strengthen cultural identity, underscoring the broader educational value of practice-based learning. At the same time, more critical perspectives highlight the limits of experiential models. Valencia Arnica (2023) notes that courses relying solely on practical engagement may fragment learning and weaken theoretical coherence. Complementing these views, Guo (2025) demonstrates that hybrid formats, in which hands-on practice is supported by asynchronous reflection, generate more sustainable motivational gains. Taken together, these findings suggest that while experience is indispensable, it attains full pedagogical value only when embedded within structured reflection and complemented by diverse modes of learning.

Interview accounts further enrich this interpretation. Inheritors emphasized that students must physically engage with bamboo in order to perceive its resilience and to understand the cultural wisdom encoded in weaving. Teachers described the pedagogical importance of iterative cycles of practice and reflection. Enterprise representatives highlighted the employability advantages that accrue from strong practical skills. Administrators viewed experiential approaches as especially compatible with vocational education's emphasis on practice. Taken together,experience is indispensable but attains full value only when embedded in reflection and complemented by diverse modes.

5.4 Foundational Role and Development Direction of Inheritors' Collaborative Teaching Ability

Although regression results indicate that inheritors' collaborative teaching ability ranks lowest among the four

predictors ($\beta = 0.286$, $p < 0.001$), its significance remains clear. Inheritors are not only practitioners of technical skills but also carriers of cultural depth and historical continuity. Without their participation, curricula risk becoming superficial and disconnected from the intangible values embedded in craft traditions. The empirical evidence therefore suggests that inheritors' roles are being redefined rather than diminished, moving from solitary masters to collaborative educators and cultural communicators within vocational systems.

The resource-based view provides a theoretical lens for understanding this evolution. Inheritors embody rare and inimitable cultural knowledge that functions as a strategic educational resource. Recent studies highlight, however, that traditional master–apprentice systems face constraints in scalability and adaptability to institutional contexts. Research on intangible cultural heritage in higher education emphasizes that inheritors must operate within structured teaching environments that integrate innovation, technology, and institutional support rather than relying solely on one-to-one mentorship (Kou, 2024). Guo (2025) further shows that bichronous modes combining synchronous practice and asynchronous reflection improve motivation and engagement in heritage education, which implies that inheritors may increasingly need to adapt to hybrid pedagogical models where their role focuses on cultural demonstration during synchronous learning. Parallel work on teachers' perceptions of cultural heritage education with technology indicates that educators often perceive tension between digital mediation and cultural authenticity (Ulutaş, 2025). In addition, community-centered approaches to heritage preservation suggest that sustainable transmission requires expanding responsibility beyond individual masters to collaborative networks that integrate inheritors, teachers, and local communities (Banda et al., 2024).

Qualitative interviews provide further evidence of these dynamics. Inheritors acknowledged the challenges of moving from individualized mentorship to large classroom settings, as well as difficulties in adopting digital platforms and interdisciplinary collaboration. Teachers observed that while inheritors provide irreplaceable authenticity, they often lack systematic pedagogical methods. Industry stakeholders emphasized the importance of enhancing inheritors' cross-disciplinary communication and collaborative capacity to meet evolving labor market demands. Administrators reported initiatives to establish dual-instructor models where inheritors focus on cultural transmission while professional teachers manage instructional design and technological integration.

In summary, inheritors' collaborative teaching ability continues to represent a foundational dimension of curriculum development. Yet its future effectiveness depends on systematic institutional support, integration into hybrid learning environments, and the creation of participatory frameworks. Rather than sole tradition-bearers, inheritors should be recognized as partners in a broader ecosystem of educational innovation and cultural preservation.

5.5 Holistic Significance and Theoretical Contributions of Research Findings

Combining empirical analysis and interview results, it can be seen that the "four-dimensional collaboration" framework proposed in this research—market demand alignment, technological empowerment, experiential curriculum design, and inheritors' collaborative teaching ability—jointly constitute the core mechanism of Qingshen bamboo weaving curriculum development. These four dimensions do not exist in isolation but form an educational value chain through interaction and integration. Market demand alignment provides direction, technological empowerment provides tools, experiential curriculum design carries practical scenarios, while inheritors' collaborative teaching ability ensures cultural depth and orthodoxy. The coordinated operation of the four factors shows that the success of traditional craft education does not depend on any single element but relies on multi-dimensional comprehensive action and dynamic balance. More importantly, these four dimensions interact as an integrated system rather than functioning in isolation. Market Demand Alignment provides the external orientation that directs educational resources toward social and industrial needs. Technological Empowerment acts as the enabling mechanism, expanding the scale, efficiency, and accessibility of craft education. Experiential Curriculum Design translates orientations and tools into concrete pedagogical practices, ensuring that learning remains both culturally grounded and practically effective. Inheritors' Collaborative Teaching Ability anchors this process, embedding authenticity and cultural depth to prevent the curriculum from drifting toward mere utilitarianism. Their interplay is cyclical and mutually reinforcing: market demand stimulates the adoption of technology, technology expands the scope of experiential learning, experiential design highlights the indispensable role of inheritors, and inheritors' cultural authority in turn legitimizes market-oriented innovations. Through these feedback loops, the "educational value chain" evolves from a linear sequence into a dynamic ecosystem, where sustainable improvement and innovation emerge from the continuous integration of cultural, educational, and industrial logics.

At the theoretical level, this research's contribution is mainly reflected in three aspects. First, introducing value chain management theory into traditional craft education provides a framework for analyzing curriculum development

systematicity and verifies the core role of market demand alignment as a“value chain integrator.” Second, this research applies resource-based view to educational contexts, emphasizing inheritors' collaborative teaching ability as scarce resource value, supplementing understanding of educational resource management. Third, the research combines stakeholder theory, revealing collaborative interaction logic among multiple stakeholders including educational institutions, enterprises, inheritors, and students, promoting cross-field dialogue between educational management and cultural industry research. These contributions jointly enrich the academic system of traditional craft education.

Practical significance is reflected in insights for vocational education and cultural inheritance policies. Market-oriented educational mechanisms suggest that curricula must balance cultural protection and industry adaptation; the strategic significance of technological empowerment indicates increased investment in digital platforms and tools should be made; verification results of experiential curriculum design emphasize the importance of practice-oriented teaching; while the foundational role of inheritors' collaborative teaching ability reminds managers that policy design should pay more attention to support and cultivation of inheritors. Overall, this research not only provides empirical reference for Qingshen bamboo weaving education but also provides generalizable ideas for reform of other traditional craft education. Its overall contribution lies in proposing a comprehensive solution that balances educational effectiveness, cultural inheritance, and industry development, providing dual theoretical and practical support for future vocational education reform and cultural industry development.

6. Conclusions and Recommendations

6.1 Main Research Conclusions

This research, grounded in value chain theory, resource-based view, and stakeholder theory, empirically tested key influencing factors in Qingshen bamboo weaving curriculum development through 350 questionnaires and in-depth interviews with 12 key informants. Multiple regression results demonstrate that market demand alignment is the primary factor affecting curriculum effectiveness (β=0.356), followed by technological empowerment (β=0.349), experiential curriculum design (β=0.291), and inheritors' collaborative teaching ability (β=0.286), with the overall model explaining 47.2% of variance. This ranking both addresses practical challenges in educational practice and provides theoretical foundations for prioritizing curriculum development strategies.

The significance of the conclusions operates on three levels. First, they challenge the mainstream “inheritor-centered” paradigm in traditional craft education. Research demonstrates that while inheritors' collaborative teaching ability remains crucial for curriculum success, market demand alignment and technological empowerment exert stronger decisive influence in modern vocational education contexts. This shift reflects a structural transformation from closed transmission models toward industry-oriented approaches. Second, experiential curriculum design is confirmed as an important mechanism for educational value chain optimization, not only transmitting skills but also connecting cultural experience, innovation capabilities, and professional requirements through practice-based platforms. Third, complementarity and synergistic effects exist among the four factors, indicating that curriculum development effectiveness depends not on single elements but on holistic integration of multiple dimensions.

In summary, this research's theoretical contribution lies in proposing and validating the “four-dimensional collaborative” framework, revealing dynamic relationships among market orientation, technological empowerment, instructional design, and cultural resources. The practical contribution provides clear priority pathways for traditional craft education curriculum development: market demand alignment as orientation, technological empowerment as enabling tools, experiential curriculum design as platforms, and inheritors' collaborative teaching ability as cultural core, thereby achieving organic unity of educational effectiveness, industrial value, and cultural transmission.

6.2 Practical Recommendations and Policy Implications

Based on research findings, systematic recommendations emerge across three levels: curriculum development, educational management, and policy support. First, regarding curriculum development, market demand alignment should guide establishment of school-enterprise collaborative curriculum design mechanisms. Vocational institutions should develop close partnerships with bamboo weaving enterprises, jointly formulating teaching objectives and evaluation standards while introducing authentic enterprise projects as teaching tasks, achieving precise alignment between instructional content and market demand alignment requirements. Through this approach, students acquire both traditional skills and market-oriented capabilities, thereby enhancing employability and professional competitiveness.

Second, in educational management, accelerating deep integration between modern information technology and

traditional craft curricula is essential. Schools should invest in virtual simulation teaching platforms and online learning resource databases, utilizing VR and AR tools for immersive learning experiences. Simultaneously, administrators should strengthen teacher-inheritor cooperation, promoting dual-instructor teaching models: inheritors focusing on skill and cultural transmission, teachers handling instructional design and technological empowerment application. Through complementary advantages, teaching organizational efficiency and cultural inheritance effectiveness improve. Additionally, establishing school-enterprise joint training bases enables students to learn in authentic production environments, further enhancing curriculum practicality and applicability.

Finally, at the policy level, government support for traditional craft education-industry integration through specialized measures is needed. Fiscal subsidies, industrial funds, and talent incentive policies can support school-enterprise collaborative training projects. Establishing inheritor education and training programs can enhance their modern teaching and industry collaboration capabilities. Improving vocational education evaluation systems can incorporate market demand alignment and cultural value into quality assessment indicators. Such measures will advance the standardization, systematization, and sustainability of Qingshen bamboo weaving curriculum development while providing policy exemplars for other traditional craft education.

6.3 Research Limitations and Future Prospects

Despite generating systematic empirical results, several limitations warrant acknowledgment. The sample concentrated primarily in Sichuan Province, limiting cross-regional comparisons that may affect generalizability across diverse different economic conditions, cultural traditions, and educational environments. Future research should expand geographical scope to enhance external validity.

Methodologically, this cross-sectional design revealed variable correlations but could not capture dynamic causal relationship evolution. Given that traditional craft education effects often require years to manifest, longitudinal tracking studies or experimental designs would better validate model dynamic mechanisms.

Measurement approaches also present limitations. While questionnaire instruments passed reliability and validity testing, respondent subjectivity bias may persist. Incorporating behavioral observation, work analysis, and learning process data could strengthen robustness. Similarly, qualitative insights derived from limited number of interviews could be enriched through larger-scale case studies or international comparative analyses.

Theoretically, this investigation identified and ranked key management factors without fully examining interaction effects and underlying mechanisms. Critical questions remain: Does market demand alignment indirectly influence teaching effectiveness through experiential curriculum design? Does technological empowerment mediate or moderate relationships between market demand alignment and inheritors' collaborative teaching ability? Structural equation modeling could illuminate these complex multi-dimensional relationships.

Future research directions include comparative studies across diverse traditional crafts, investigating differences in industry adaptation, instructional design, and cultural transmission models. Such inquiries would provide empirical foundations for more generalizable theoretical frameworks while advancing both educational management and cultural preservation scholarship.

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