

A Structural Causal Analysis of Teaching Quality in Higher Education Institutions in Shanxi, China

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ABSTRACT

The purpose of this study was to construct and verify the causal model of teaching quality in Shanxi universities, and to systematically analyze the direct and indirect impacts of teacher training and development, teacher evaluation system, policy reform, university management policy, teacher development and student learning effectiveness on teaching quality. The study used questionnaires, in-depth interviews and field observations to collect data, covering teachers, students and administrators of three public undergraduate universities in Shanxi Province. Through structural equation model analysis, the study reveals the complex relationship and action path between various variables and finds that teacher training and development plans and education management policies indirectly affect teaching quality through teacher evaluation system and university management policy, while teacher development and student learning effectiveness show a significant direct impact. The results of this study not only enrich the theoretical system in the field of teaching quality in colleges and universities but also provide empirical basis and practical suggestions for the optimization of education management policies, the support of teachers' professional development and the improvement of students' learning experience in Shanxi universities. At the same time, the study emphasizes the key role of policy implementation, fairness of resource allocation and teacher incentive mechanism in promoting the improvement of teaching quality, which has important theoretical value and practical significance.

Keywords Teaching Quality, Teacher Training and Development, Educational Management Policies, Student Learning Outcomes, Causal Models

Introduction

In the context of Shanxi Province, China, national initiatives such as the National Teacher Training Plan have significantly expanded opportunities for teacher professional development. Despite these efforts, considerable challenges remain in aligning training programs with the practical needs of classroom instruction. Furthermore, the effectiveness of Continuing Professional Development (CPD) is frequently constrained by limited follow-up support and the absence of performance-based incentive mechanisms, reducing its potential impact on teaching practice and student learning outcomes [1]. These conditions suggest that improving teaching quality requires not only greater access to professional development but also systematic mechanisms that ensure the transfer of acquired knowledge and skills into effective instructional practices.

This study therefore emphasizes the importance of integrating CPD policies with teaching performance indicators and establishing sustainable institutional

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Additional Information and
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support systems that promote continuous professional growth and measurable improvements in teaching effectiveness. Such an approach is consistent with global trends in higher education reform, which recognize that sustainable improvements in teaching quality require comprehensive institutional transformation involving educational policy, organizational culture, and active faculty engagement [2], [3]. Recent research further indicates that educational policies alone are insufficient to produce meaningful outcomes unless they are supported by effective implementation, continuous evaluation, timely feedback, and adaptation to local institutional contexts [4].

International evidence also demonstrates that participatory governance and teacher-centered policy development contribute more effectively to teaching quality than traditional top-down administrative approaches [5]. Consequently, universities in Shanxi should strengthen inclusive policy development by encouraging active participation from faculty members and students in educational decision-making. Such collaborative governance can ensure that institutional reforms are closely aligned with the realities of teaching and learning while fostering greater ownership and commitment among stakeholders.

Another critical factor influencing teaching quality is the ongoing digital transformation of higher education. The rapid expansion of online and hybrid learning environments has created new expectations for quality assurance systems, requiring them to evaluate digital pedagogical competence, student engagement in virtual classrooms, and the effective integration of educational technologies into teaching practices [6]. Although universities in Shanxi have increasingly adopted smart learning environments, inadequate teacher preparation in digital pedagogy remains a significant challenge. Therefore, future educational development should prioritize strengthening teachers' digital competencies while ensuring that information and communication technology (ICT) infrastructure effectively supports pedagogical objectives.

Equitable resource allocation and balanced academic workloads also play a fundamental role in maintaining teaching quality. Faculty members frequently experience competing demands between research productivity and teaching responsibilities, particularly in institutions with limited resources. As a result, developing equitable performance evaluation systems that recognize teaching excellence alongside research achievements is essential for promoting long-term educational quality and sustaining faculty motivation [7].

In addition to institutional and technological considerations, the cultural and regional characteristics of Shanxi Province require context-sensitive approaches to educational quality improvement. The province's socio-economic conditions, historical background, and diverse student population create unique educational challenges that cannot be addressed through standardized national policies alone. For example, students from rural backgrounds may require differentiated academic support and inclusive learning strategies to achieve comparable educational outcomes. Accordingly, universities should incorporate diversity-sensitive policies and inclusive teaching practices into their quality assurance frameworks to ensure equitable learning opportunities for all students [8].

Overall, previous studies consistently demonstrate that sustainable

improvements in teaching quality depend on comprehensive, flexible, and context-responsive educational management strategies that integrate supportive policies, effective institutional leadership, continuous professional development, stakeholder participation, technological readiness, and evidence-based quality assurance mechanisms [9], [10], [11], [12], [13]. Building upon these perspectives, the present study aims to develop a causal model of teaching quality in colleges and universities in Shanxi Province and to propose practical strategies and guidelines for enhancing teaching quality based on the current educational context. The findings are expected to contribute to both theoretical understanding and practical policymaking by providing evidence-based recommendations for strengthening teaching quality management in higher education institutions.

Research Methodology

This study employed a quantitative research approach using Structural Equation Modeling (SEM) to examine the causal relationships among teacher evaluation systems, teacher training and development programs, university management policies, policy reform, teacher development, and teaching quality in higher education institutions in Shanxi Province, China. The conceptual framework was developed based on previous theoretical and empirical studies and consists of seven hypothesized relationships (H1–H7), as illustrated in figure 1. SEM was selected because it enables the simultaneous examination of multiple latent variables and causal relationships while accounting for measurement error, making it suitable for validating complex educational management models [14], [15].

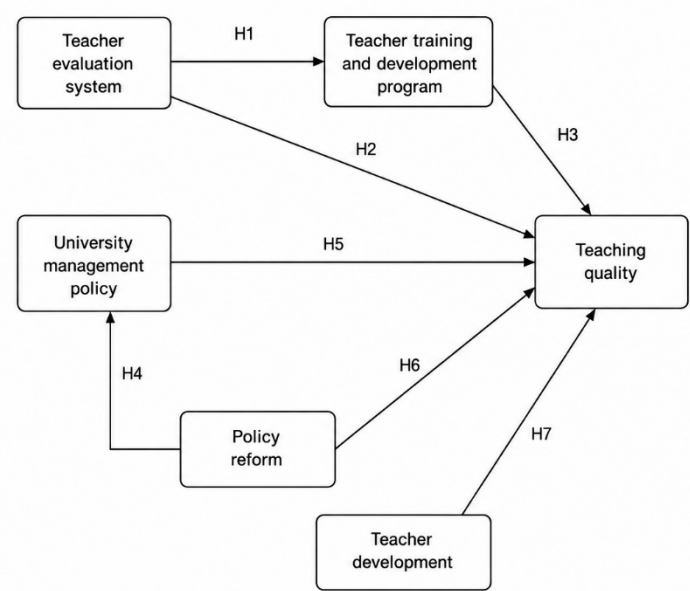


Figure 1 Conceptual Framework of the Research

Population and Sample

The target population comprised undergraduate students enrolled in the Faculties of Education at Shanxi University, Datong University, and Yuncheng

University during the 2024–2025 academic year. The estimated population was approximately 3,050 students (see [table 1](#)). Only full-time undergraduate students were included to ensure consistency in academic experience and institutional context.

The sample consisted of 406 students selected using stratified purposive sampling. Stratification was based on the number of enrolled students in each university to ensure proportional representation across institutions while maintaining comparable academic characteristics. This sampling technique is considered appropriate for studies involving heterogeneous populations and latent variable modeling because it improves representativeness and supports reliable parameter estimation [\[16\]](#).

Table 1 Sample Distribution				
No.	University	Faculty Selected	Population	Sample group
1	Shanxi University	Faculty of Education	1200	122
2	Datong University	Faculty of Education	1000	182
3	Yuncheng University	Faculty of Education	850	102
Total	— —	3050	406	

Research Instruments

Data were collected using a structured questionnaire designed to measure the latent constructs in the proposed research model, namely Teacher Evaluation System, Teacher Training and Development Program, University Management Policy, Policy Reform, Teacher Development, and Teaching Quality. Each construct was measured using multiple observed indicators adapted from established literature and modified to fit the context of Chinese higher education [\[17\]](#).

The questionnaire employed a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). Prior to the main survey, the instrument underwent expert review to assess content validity and was pilot-tested to evaluate clarity, reliability, and construct suitability. Necessary revisions were made based on expert recommendations and pilot study findings to improve measurement accuracy and consistency [\[18\]](#).

In addition to the questionnaire, semi-structured interviews with university administrators and academic staff were conducted to obtain supplementary qualitative information regarding institutional policies, teacher development practices, and quality assurance mechanisms. The interview findings were used to support the interpretation of quantitative results rather than as the primary source of analysis [\[19\]](#).

Data Collection and Analysis

Data collection was conducted through both face-to-face and online survey administration after obtaining institutional permission and informed consent from all participants. Respondents were informed that participation was voluntary and that all collected information would remain confidential and be used solely for

academic research purposes [20].

The collected data were analyzed using descriptive statistics to summarize respondents' demographic characteristics and variable distributions. Confirmatory Factor Analysis (CFA) was subsequently performed to evaluate the validity and reliability of the measurement model by examining factor loadings, composite reliability (CR), and average variance extracted (AVE). Structural Equation Modeling (SEM) was then employed to test the proposed hypotheses (H1–H7) and evaluate the direct effects among latent constructs. Model adequacy was assessed using commonly accepted goodness-of-fit indices, including Chi-square/df, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Goodness-of-Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), following established SEM guidelines [21].

Hypothesis Development

Teaching quality in higher education is influenced by multiple organizational, managerial, and professional factors that interact within the institutional environment. Previous studies have demonstrated that teacher evaluation systems, professional development programs, university management policies, policy reforms, and teacher development collectively contribute to improving teaching effectiveness and student learning outcomes [2], [3], [5], [9]. Based on these theoretical perspectives and empirical findings, the present study proposes seven hypotheses to examine the causal relationships among the latent constructs.

Teacher evaluation systems are essential mechanisms for monitoring instructional performance, identifying areas for improvement, and providing constructive feedback for academic staff. Effective evaluation systems not only assess teaching performance but also encourage continuous professional learning by identifying competency gaps and informing future training initiatives [1], [7]. Universities that implement transparent and comprehensive evaluation systems are more likely to establish professional development programs that respond to teachers' actual needs and support continuous instructional improvement [14], [17]. Therefore, the following hypothesis is proposed.

H1: Teacher evaluation systems positively influence teacher training and development programs.

Teacher evaluation also functions as an important quality assurance mechanism that directly contributes to improving teaching quality. Continuous evaluation through student feedback, peer review, classroom observation, and performance appraisal enables teachers to identify weaknesses and improve instructional practices. Regular evaluation also strengthens accountability and encourages the adoption of more effective teaching methods, ultimately enhancing student learning outcomes [5], [10], [18]. Therefore, the following hypothesis is proposed.

H2: Teacher evaluation systems positively influence teaching quality.

Teacher training and development programs provide educators with opportunities to improve pedagogical knowledge, instructional skills, research competence, and digital literacy. Continuous professional development enables

teachers to adopt innovative teaching strategies, integrate educational technology into learning activities, and respond effectively to changing educational demands [1], [6], [11]. Previous studies have consistently shown that teachers who participate in continuous professional development demonstrate higher instructional effectiveness and contribute to improved teaching quality [15], [19]. Therefore, the following hypothesis is proposed.

H3: Teacher training and development programs positively influence teaching quality.

Educational policy reform plays a strategic role in strengthening institutional governance by introducing new regulations, management approaches, and quality assurance systems. Universities often revise their management policies in response to national education reforms and changing societal expectations. Effective policy reform provides a foundation for improving administrative efficiency, faculty support, and institutional accountability [3], [4], [12]. Consequently, policy reform is expected to strengthen university management policy.

H4: Policy reform positively influences university management policy.

University management policy establishes the institutional environment in which teaching activities are planned, implemented, monitored, and evaluated. Policies related to faculty development, teaching quality assurance, workload allocation, and performance evaluation create conditions that support instructional excellence and sustainable educational improvement [8], [13], [20]. Institutions with effective management policies are generally better positioned to improve teaching quality and enhance student learning experiences. Therefore, the following hypothesis is proposed.

H5: University management policy positively influences teaching quality.

Policy reform may also directly influence teaching quality by promoting curriculum innovation, strengthening quality assurance systems, encouraging the integration of educational technologies, and improving institutional governance. Educational reforms that are effectively implemented enable universities to adapt teaching practices to contemporary educational needs while maintaining high academic standards [4], [6], [16]. Therefore, policy reform is expected to exert a direct positive effect on teaching quality.

H6: Policy reform positively influences teaching quality.

Teacher development reflects continuous improvement in teachers' professional competence, instructional ability, research capability, career advancement, and professional satisfaction. Faculty members who continuously develop their knowledge and professional skills are more capable of implementing innovative teaching methods, responding to diverse student needs, and creating engaging learning environments [7], [11], [21]. Enhanced teacher development also contributes to better teaching performance and stronger student learning outcomes. Therefore, the following hypothesis is proposed.

H7: Teacher development positively influences teaching quality.

Based on the theoretical and empirical evidence presented above, the proposed conceptual framework assumes that teaching quality is jointly influenced by

teacher evaluation systems, teacher training and development programs, university management policy, policy reform, and teacher development. The seven hypotheses are empirically tested using Structural Equation Modeling (SEM) to examine the direct causal relationships among the latent constructs and validate the proposed research model [14], [15], [21].

Research Results

Respondents' Demographic Characteristics

Table 2 presents the demographic characteristics of the respondents who participated in this study. A total of 406 valid responses were obtained from academic staff working at three universities in Shanxi Province. The demographic profile includes gender, age, years of teaching experience, academic position, and institutional type. These characteristics provide an overview of the sample composition and help determine whether the respondents adequately represent the target population.

Table 2 Descriptive Analysis of Demographic Characteristics			
No.	Basic Information	Number	Percentage
Gender	Male	185	45.6
	Female	221	54.4
	Total	400	100
Age (years)	Under 30 years	88	21.8
	31-40 years	255	62.8
	41-50 years	34	8.4
	Over 50 years	29	7.0
	Total	406	100
Years of teaching experience	Below 1 year	49	12.1
	1 – 3 years	139	34.2
	3 – 5 years	107	26.4
	5 – 10 years	85	20.9
	Among 10 years	26	6.4
	Total	406	100
Academic title/position	Assistant Lecturer/Instructor	77	19
	Lecturer	160	39.4
	Assistant Professor	127	31.3
	Associate Professor	34	8.4
	Professor	8	2
	Total	406	100
Type of institution	Comprehensive University	112	27.6
	Normal University (Teacher Education)	134	33
	Specialized/Professional College	116	28.6
	Other	44	10.8

Total	406	100
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The results indicate that female respondents accounted for a slightly higher proportion than male respondents, representing 54.4% of the sample. Most respondents were between 31 and 40 years of age (62.8%), indicating that the majority of participants were in the middle stage of their academic careers. Regarding teaching experience, the largest group had between one and three years of teaching experience (34.2%), followed by those with three to five years of experience (26.4%). In terms of academic position, lecturers represented the largest proportion of respondents (39.4%), while assistant professors accounted for 31.3%. The respondents were drawn from different types of higher education institutions, with normal universities contributing the largest proportion (33.0%), followed by specialized colleges (28.6%) and comprehensive universities (27.6%). The diversity of respondents enhances the representativeness of the sample and provides a broad perspective on teaching quality across different institutional contexts.

In addition to describing the respondents' demographic profile, descriptive statistical analysis was conducted for the principal latent constructs included in the proposed research model. These constructs comprise the Teacher Evaluation System (TES), Teacher Training and Development Program (TTDP), University Management Policy (UMP), Policy Reform (PR), Teacher Development (TD), and Teaching Quality (TQ). The analysis includes the mean, standard deviation, skewness, and kurtosis of each construct to examine respondents' overall perceptions, the degree of response variability, and the distributional characteristics of the data.

Descriptive statistics serve as an important preliminary step before conducting multivariate analysis because they provide evidence regarding the quality of the dataset and the suitability of the observed variables for model estimation. The assessment of skewness and kurtosis is particularly important for evaluating the assumption of multivariate normality, which is required for maximum likelihood estimation in Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). Values within the recommended thresholds indicate that the data are sufficiently normally distributed and appropriate for subsequent validity, reliability, and structural model analyses.

Reliability and Validity Analysis

To further examine the measurement quality of the research instrument, reliability testing was conducted for each construct. Cronbach's alpha coefficients were calculated to assess internal consistency, while the Item-Objective Congruence (IOC) ensured content validity during the expert review stage.

To sum up, the evidence from [table 3](#) confirms that the instrument used in this study possesses both high reliability and strong validity. These results provide a solid foundation for conducting further analyses, particularly the structural equation modeling in the following sections, to test the causal model of teaching quality in Shanxi colleges and universities.

Table 3 Reliability and Convergent Validity Analysis				
Dimension	Cronbach's Alpha	rho_A	Composite	Average

	Reliability (CR)			Variance Extracted (AVE)
PR	0.885	0.896	0.929	0.813
TD	0.888	0.889	0.923	0.749
TES	0.91	0.912	0.931	0.692
TQ	0.85	0.85	0.909	0.77
TTD	0.903	0.903	0.928	0.72
UMP	0.89	0.891	0.924	0.752

Correlation Analysis

With the reliability and validity of the measurement model firmly established, the next step in the analysis is to examine the structural model in order to test the hypothesized causal relationships among the latent variables. Structural Equation Modeling (SEM) was employed to evaluate both the direct and indirect effects specified in the research framework. This procedure allows for simultaneous estimation of multiple relationships while accounting for measurement error, thereby providing a more comprehensive assessment of the theoretical model. The evaluation of the structural model was conducted using two primary criteria: 1) overall model fit indices, which determine whether the proposed model adequately represents the observed data, and 2) the path coefficients, which assess the strength and significance of the hypothesized relationships between constructs. The results of these analyses are presented in the following subsections.

The correlation analysis provided in [table 4](#) confirms that the latent constructs are significantly related in the expected directions, thereby offering preliminary support for the hypothesized relationships in the conceptual model. Importantly, the correlation coefficients remain below the critical threshold of 0.85, suggesting that issues of multicollinearity are not present and that each construct retains sufficient distinctiveness for structural analysis. Building upon these results, the next step involves testing the hypothesized causal paths among the constructs through Structural Equation Modeling (SEM). This approach allows for a simultaneous examination of both direct and indirect effects, while also providing a comprehensive assessment of overall model fit. The subsequent section presents the results of the structural model evaluation, including fit indices and the path coefficients associated with each hypothesis.

Table 4 Correlation Analysis

TES	TTD	UMP	PR	TD	TQ	
TES	1					
TTD	0.658**	1				
UMP	0.620**	0.652**	1			
PR	0.275**	0.252**	0.272**	1		
TD	0.628**	0.634**	0.605**	0.229**	1	
TQ	0.579**	0.599**	0.611**	0.309**	0.572**	1

Having established the adequacy of the model and the absence of collinearity issues, the next step involves examining the path coefficients to test the

hypothesized relationships among the latent constructs. The results of the structural path analysis, including standardized coefficients, t-values, and significance levels, are presented in the following [table 5](#).

Table 5 Path Coefficients

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T	p Value
PR -> TQ	0.106	0.106	0.04	2.666	0.008
PR -> UMP	0.275	0.274	0.048	5.718	0.000
TD -> TQ	0.171	0.168	0.05	3.391	0.001
TES -> TQ	0.16	0.165	0.047	3.375	0.001
TTD -> TES	0.657	0.66	0.033	19.77	0.000
TTD -> TQ	0.194	0.19	0.051	3.827	0.000
UMP -> TQ	0.253	0.253	0.046	5.475	0.000
PD -> UT	0.16	0.159	0.037	4.315	0.000
WE -> JS	0.266	0.266	0.046	5.74	0.000
WE -> PD	0.284	0.285	0.047	6.014	0.000
WE -> UT	0.251	0.25	0.038	6.539	0.000

The [table 5](#) show that the Work Environment (WE) was positively associated with Professional Development (PD) ($\beta = 0.284$, $t = 6.014$, $p < 0.001$), Job Satisfaction (JS) ($\beta = 0.246$, $t = 5.744$, $p < 0.001$), and University Teachers' Teaching Ability (UT) ($\beta = 0.251$, $t = 6.539$, $p < 0.001$). Similarly, PD positively influenced UT ($\beta = 0.166$, $t = 4.315$, $p < 0.001$), highlighting the mediating role of professional development in translating favorable work environments into improved teaching performance.

To sum up, the results confirm that teacher training, evaluation systems, performance reviews, and supportive work environments contribute significantly to enhancing teaching quality and university teachers' effectiveness, both directly and indirectly through professional development, management policies, and job satisfaction.

[Table 6](#) reports the results of the mediation effect analysis. The findings indicate that two significant indirect effects were present in the model.

Table 6 Mediation Effect Analysis

Path	O	M	STDEV	T	p Value	95%CI	
						Lower	Upper
TTD → TES → TQ	0.105	0.109	0.033	3.165	0.002	0.048	0.173
PR → UMP → TQ	0.069	0.069	0.018	3.931	0.000	0.037	0.107

Note: Original Sample (O), Sample Mean (M), Standard Deviation (STDEV)

First, Teacher Training and Development (TTD) exhibited a significant indirect effect on Teaching Quality (TQ) through Teacher Evaluation Systems (TES) ($\beta = 0.105$, $t = 3.165$, $p = 0.002$, 95% CI [0.048, 0.173]). This result demonstrates that TES partially mediates the relationship between TTD and TQ, suggesting that improvements in teacher training contribute to higher-quality teaching indirectly by strengthening teacher evaluation mechanisms.

Second, Performance Review (PR) showed a significant indirect effect on TQ through University Management Policies (UMP) ($\beta = 0.069$, $t = 3.931$, $p < 0.001$, 95% CI [0.037, 0.107]). This finding implies that PR influences teaching quality not only directly but also indirectly by shaping management policies that create a more effective institutional environment for teaching.

To sum up, these mediation results highlight the importance of intermediary mechanisms such as evaluation systems and management policies. They serve as critical pathways through which teacher training and performance review exert their broader impact on teaching quality.

Discussion

Discussion for Objective 1: Causal Model of Teaching Quality

The findings of this study confirm that teaching quality in higher education is determined by the interaction between institutional governance, teacher professional development, and educational management practices. The proposed structural model demonstrated satisfactory explanatory power, indicating that the relationships among the Teacher Evaluation System (TES), Teacher Training and Development Program (TTDP), University Management Policy (UMP), Policy Reform (PR), Teacher Development (TD), and Teaching Quality (TQ) are theoretically and empirically supported. These findings reinforce the view that teaching quality is a multidimensional construct that extends beyond individual teaching competence and is strongly influenced by institutional support systems and organizational policies [2], [3], [9].

The positive influence of the Teacher Evaluation System on both Teacher Training and Development Program and Teaching Quality indicates that effective evaluation systems function not only as accountability mechanisms but also as instruments for continuous professional improvement. Comprehensive evaluation systems that incorporate student feedback, peer review, teaching observation, and performance appraisal provide valuable information that enables teachers to identify instructional strengths and weaknesses and continuously improve their teaching practices [1], [5], [14]. This finding is consistent with previous studies suggesting that formative evaluation contributes more effectively to teaching improvement than evaluation systems designed solely for administrative accountability [10], [18].

The results further demonstrate that Teacher Training and Development Programs significantly improve teaching quality. Continuous professional development equips teachers with updated pedagogical knowledge, instructional strategies, research capability, and digital competencies required in contemporary higher education. These findings support previous research indicating that professional learning is most effective when it is continuous, practice-oriented, and directly connected to classroom implementation rather than limited to isolated training activities [6], [11], [15]. Consequently, universities should establish sustainable professional development systems that encourage lifelong learning and continuous instructional innovation.

Policy Reform also emerged as an important institutional factor influencing teaching quality. The results suggest that policy reform contributes both directly to teaching quality and indirectly through University Management Policy.

Educational reforms provide universities with opportunities to strengthen governance structures, improve quality assurance systems, revise faculty development policies, and allocate institutional resources more effectively [3], [4], [12]. When educational reforms are implemented consistently and supported by institutional commitment, they create organizational conditions that facilitate continuous improvement in teaching performance.

Similarly, University Management Policy demonstrated a significant positive influence on Teaching Quality. Institutional policies governing faculty development, workload allocation, performance evaluation, promotion systems, and resource distribution create an organizational climate that either facilitates or constrains effective teaching practices. Universities with transparent management systems and supportive governance structures are more likely to foster teacher engagement, instructional innovation, and organizational commitment, ultimately contributing to higher teaching quality [8], [13], [20].

Teacher Development was also found to positively influence Teaching Quality, confirming that continuous improvement in teachers' instructional competence, professional skills, research capability, and career development enhances classroom effectiveness. Teachers who continuously develop their competencies are better prepared to implement innovative pedagogical approaches, integrate educational technologies, and respond to diverse student learning needs [7], [11], [21]. This finding highlights teacher development as a critical component of sustainable educational quality improvement.

Overall, the validated causal model demonstrates that teaching quality is influenced by an integrated system of institutional governance and professional development rather than by isolated organizational initiatives. Sustainable improvement in teaching quality therefore requires coordinated efforts that combine effective evaluation systems, continuous professional development, supportive institutional policies, and strategic educational reform [2], [5], [9], [14].

Discussion for Objective 2: Strategies and Guidelines for Improving Teaching Quality

Based on the validated causal model, several practical strategies can be proposed to strengthen teaching quality in higher education institutions. First, universities should redesign teacher evaluation systems to emphasize formative feedback rather than administrative compliance. Evaluation systems that integrate multiple sources of evidence—including student evaluations, peer observations, self-reflection, and administrative assessment—provide more comprehensive information for improving instructional performance and encouraging professional growth [1], [5], [18].

Second, universities should strengthen Teacher Training and Development Programs by adopting continuous professional learning models instead of one-time training activities. Sustainable professional development should incorporate mentoring, collaborative learning communities, classroom-based reflection, and technology-enhanced instructional development. Such approaches enable teachers to continuously update their pedagogical competencies while responding to rapidly changing educational environments [6], [11], [15].

Third, university management policies should promote transparent governance, equitable resource allocation, balanced workload distribution, and fair performance evaluation systems. Institutional policies that recognize teaching excellence alongside research productivity encourage greater faculty engagement and reduce conflicts between teaching and research responsibilities [7], [8], [20]. These management practices contribute to a supportive organizational environment that enhances both teacher motivation and instructional effectiveness.

Fourth, policy reform should be implemented as a continuous institutional improvement process rather than as isolated administrative initiatives. Effective educational reform requires consistency, stakeholder participation, institutional readiness, and alignment between national educational objectives and university-level implementation strategies [3], [4], [12]. Universities should therefore establish mechanisms for continuous policy evaluation and revision to ensure that institutional policies remain responsive to evolving educational needs.

Collectively, these strategies demonstrate that improving teaching quality requires a comprehensive institutional approach integrating governance, professional development, quality assurance, and organizational support. The findings indicate that sustainable educational improvement depends on the alignment of institutional policies, management practices, faculty development initiatives, and quality evaluation systems within a coherent educational management framework [2], [9], [13].

Future Research Directions

Although the present study provides empirical evidence supporting the proposed causal model, several opportunities remain for future research. First, future studies should extend the model to universities in different provinces and institutional categories, including research universities, vocational institutions, and private universities, in order to improve the external validity and generalizability of the findings [16], [20].

Second, longitudinal research designs are recommended to investigate how teaching quality evolves over time in response to institutional reforms, faculty development initiatives, and changes in educational policy. Such designs would provide stronger evidence regarding causal relationships than cross-sectional studies [14], [21].

Third, future research should incorporate variables associated with digital transformation, including digital pedagogical competence, technology integration, online student engagement, artificial intelligence in education, and institutional digital readiness. As higher education increasingly adopts hybrid and online learning environments, these variables are expected to become increasingly important determinants of teaching quality [6], [17].

Finally, future studies should adopt more comprehensive data collection strategies by integrating multiple stakeholder perspectives, including students, university administrators, employers, alumni, and policymakers. The use of classroom observations, teaching portfolios, institutional performance indicators, and direct measures of student learning would complement self-

reported questionnaire data and provide more robust evidence for evaluating teaching quality [10], [18], [21].

Overall, future research should continue expanding theoretical models of teaching quality by incorporating institutional, technological, and contextual factors that reflect the rapidly changing landscape of higher education. A more comprehensive and multidisciplinary research agenda will contribute to the development of evidence-based educational policies and more effective institutional strategies for enhancing teaching quality in universities.

Conclusion

This study developed and validated a causal model of teaching quality in colleges and universities in Shanxi Province, China, and proposed practical strategies for improving instructional effectiveness in higher education. The proposed model examined the relationships among six latent constructs, namely Teacher Evaluation System (TES), Teacher Training and Development Program (TTDP), Policy Reform (PR), University Management Policy (UMP), Teacher Development (TD), and Teaching Quality (TQ). The results of Structural Equation Modeling (SEM) confirmed that the proposed model possesses satisfactory validity and reliability and that the hypothesized relationships among the constructs are statistically significant. These findings demonstrate that teaching quality is shaped by the combined influence of institutional governance, educational policy, professional development, and organizational support rather than by individual teacher characteristics alone.

The findings further indicate that teacher evaluation systems and teacher training and development programs play fundamental roles in enhancing teaching quality by promoting continuous professional improvement and instructional effectiveness. In addition, policy reform and university management policies create an institutional environment that supports teacher development, thereby contributing directly and indirectly to improvements in teaching quality. These results highlight the importance of establishing coherent educational policies, transparent governance systems, equitable performance evaluation, and sustainable professional development programs to strengthen teaching quality in higher education institutions.

Based on these findings, this study concludes that sustainable improvement in teaching quality requires an integrated institutional approach that aligns policy implementation, management practices, quality assurance systems, and teacher professional development within a unified educational management framework. Universities should therefore prioritize evidence-based decision-making, continuous quality improvement, and supportive organizational cultures that encourage innovation, collaboration, and lifelong professional learning. The proposed causal model also provides a useful framework for university administrators and policymakers in designing effective strategies to improve teaching quality and strengthen institutional performance. Furthermore, the findings contribute to the growing body of knowledge on higher education quality management by providing empirical evidence that may inform future research and policy development in similar educational contexts.

Declarations

Author Contributions

Conceptualization: H.L. and X.Z.; Methodology: X.Z.; Software: H.L.; Validation: H.L. and X.Z.; Formal Analysis: H.L. and X.Z.; Investigation: H.L.; Resources: X.Z.; Data Curation: X.Z.; Writing Original Draft Preparation: H.L. and X.Z.; Writing Review and Editing: X.Z. and H.L.; Visualization: H.L.; All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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