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Article

Developing Curriculum Quality Evaluation Standards for Preschool Education Programmes in China's Digital Era: Evidence from Guizhou Province

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Abstract: In the digital era, educational digitalisation has raised expectations for quality assurance and evidence-based improvement. Against this backdrop, preschool education programmes in China's higher vocational colleges require a fit-for-purpose set of curriculum quality evaluation standards. Taking Guizhou Province as a case, this research develops and validates a standards-based evaluation framework to enhance programme quality and better meet societal demand for competent early-childhood teachers. An exploratory sequential mixed-methods design was adopted, comprising four stages: policy and literature analysis together with multi-stakeholder focus-group interviews to generate an initial indicator pool; two rounds of expert consultation using the Fuzzy Delphi Method (FDM) to reach consensus on indicator importance; Fuzzy Analytic Hierarchy Process (FAHP) to derive indicator weights; and Fuzzy Comprehensive Evaluation (FCE) to pilot the standards in two higher vocational institutions in Guizhou. The resulting framework contains five first-level domains, thirteen second-level indicators, and thirty-nine third-level indicators, covering training outcomes, faculty and resources, research, social service and reputation, and quality assurance. The pilot evaluation yielded a substantially higher composite score for Institution A (0.6647) than Institution B (0.4916), consistent with their observed differences in programme capacity and standing, indicating good discriminant validity and practical utility. The framework offers a systematic reference for standards-based evaluation of preschool education programmes in China and provides methodological guidance for quality improvement in vocational education.

Keywords: Preschool Education, Higher Vocational Education, Curriculum Quality Standards, Educational Digitalisation, Guizhou Province

1. Introduction

High-quality preschool education has profound and enduring effects on children's long-term development (Heckman et al., 2010; Barnett, 2011). Evidence indicates that effective early educational interventions can significantly improve later educational attainment and socio-economic outcomes (Barnett, 2011). As a result, governments worldwide increasingly prioritise the quality of early childhood education and seek robust evaluation standards to safeguard and enhance it. In China, national policies have consistently emphasised scientific quality standard management in vocational institutions to promote sustainable development and strengthen competitiveness (General Office of the CPC Central Committee & State Council, 2021). For higher vocational colleges that prepare future preschool teachers, a dedicated set of curriculum quality evaluation standards is particularly critical. Such standards are directly related to improving teacher preparation quality and responding to the pressing social demand for highly qualified early childhood educators.

Internationally, a range of quality frameworks and assessment tools for early childhood education have been developed. For example, the National Association for the Education of Young Children (NAEYC) proposed programme quality standards covering child development, curriculum implementation, teaching staff, and family engagement. Widely used instruments such as the Early Childhood Environment Rating Scale–Revised (ECERS-R) and the Classroom Assessment Scoring System (CLASS) assess the quality of learning environments and teacher–child interactions, respectively (Harms et al., 1998; Pianta et al., 2008). International organisations such as the OECD have also highlighted the importance of early childhood education quality in policy reports. However, most of these standards and tools target kindergartens or general education systems. Preschool education programmes in higher vocational education have distinctive features, including an explicit focus on practice-oriented competence development. In China, higher vocational colleges often adopt quality standards developed for undergraduate programmes, without sufficiently accommodating vocational characteristics (Mou & Ding, 2020; Başaran et al., 2021). Research further suggests that the absence of clear standards can constrain professional development and limit quality improvement (Ahmadian et al., 2021). This gap is especially salient in western provinces such as Guizhou, where programmes face challenges including shortages of qualified faculty and unequal resource distribution, while empirical work on quality evaluation remains limited.

Given this context, developing curriculum quality evaluation standards tailored to preschool education programmes in higher vocational colleges is both necessary and timely. From a digitalisation perspective, this research integrates Fourth Generation Evaluation (which emphasises pluralistic stakeholder participation) (Guba & Lincoln, 1989), Outcome-Based Education (OBE) (Davis & Harden, 1999), and the PDCA cycle of quality management (Deming, 1986) as theoretical foundations to construct an evaluation framework. Focusing on preschool education programmes in Guizhou Province, a multi-stage approach was used to develop a scientific and systematic set of standards and to validate it through practical application. The following sections report the research process and results, with the aim of offering evidence and methodological insights for curriculum quality evaluation in China's preschool teacher education within higher vocational education.

2. Research Review

2.1 International research on quality standards and evaluation in early childhood education

Developed countries and international organisations have conducted extensive work on quality standards for early childhood education. NAEYC, for instance, issued programme standards that cover key areas such as child development, curriculum implementation, staff qualifications, and family partnerships (NAEYC, 2009). Countries such as the United Kingdom have promoted curriculum evaluation principles guided by developmentally appropriate practice (Sylva et al., 2006). Meanwhile, a series of tools have been created to operationalise quality assessment: ECERS focuses on environmental quality (Harms et al., 1998), whereas CLASS assesses the quality of classroom interactions (Pianta et al., 2008). These tools provide actionable indicators for monitoring early childhood education quality. At the policy level, OECD reports (e.g., Education at a Glance) underline the downstream effects of early childhood education quality on later learning and societal outcomes (OECD, 2019). Across contexts, an emerging trend is a combination of outcome orientation (i.e., attention to children's learning and development) and continuous improvement (i.e., using evaluation feedback to drive iterative enhancement). Table 1 summarises selected international experiences and emphases, providing reference points for this research.

Table 1 Overview of preschool education quality standards worldwide

Country/Region	Standard/Framework	Primary focus	Implications for localisation
OECD	Education Policy Outlook	Teacher professional development; diverse learner needs; quality assurance mechanisms	Adapt indicators and evidence sources to the vocational-education context.
Malaysia	Early Childhood Care and Education (ECCE) standards	Quality standards; pathways for teacher development; explicit goals and outcomes	Maintain outcome orientation while localising to China's higher vocational setting.
United States	Head Start Program Performance Standards	Early intervention and holistic child development (social-emotional, cognitive, physical)	Complement with indicators capturing practice-oriented competence development in teacher preparation.
New Zealand	Early Childhood Curriculum Framework	Community participation; shared learning processes; emphasis on life skills	Strengthen vocationally relevant skill training to align with higher vocational education.
Sweden	Preschool curriculum standards	Children's rights; participation and expression; learning environment; teacher professional development	Incorporate skill development aligned with vocational programme requirements.
Singapore	NEL Framework	Learning dispositions; integrated learning; early language and cultural development; community engagement	Enhance professional skills training appropriate to higher vocational teacher education.

2.2 Research on quality evaluation of preschool education programmes in China's higher vocational education

China has attached increasing importance to quality enhancement in vocational education. Recent policy documents, such as Opinions on Promoting the High-Quality Development of Modern Vocational Education, call for establishing and improving a vocational education quality standards system (General Office of the CPC Central Committee & State Council, 2021). In the field of preschool teacher education, scholars have discussed the construction of quality standards for talent cultivation in higher vocational preschool education programmes. For example, Mou and Ding (2020) suggested building a quality monitoring system that encompasses training objectives, curriculum design, faculty teams, and practice conditions. However, unified standards and indicators specifically designed for curriculum quality evaluation in higher vocational preschool education remain limited. Many institutions continue to reference undergraduate-oriented indicators, which may not fully reflect the practice-intensive orientation of higher vocational education (Mou & Ding, 2020). Regional disparities further complicate quality assurance: in Guizhou, for instance, relatively weak resources and uneven faculty capacity underscore the need for context-sensitive standards to guide improvement. Overall, existing domestic research is characterised by gaps in standard availability, insufficient localisation, and an incomplete system. Responding to these limitations, this research aims to develop a set of evaluation standards that integrates international insights while fitting China's vocational education environment.

3. Method

3.1 Research instruments

This research employed multiple instruments and analytic procedures to ensure that the indicator system was developed in a rigorous and reliable manner, as detailed below.

3.1.1 Focus-group interviews

An initial pool of evaluation indicators was generated through a literature review and focus-group interviews with multiple stakeholders. The focus groups included programme administrators, frontline teachers, and industry representatives from the preschool education field in higher vocational colleges. Consistent with fourth-generation evaluation, the discussions encouraged participation from different stakeholder groups and integrated their perspectives to identify key factors shaping curriculum quality. The resulting preliminary indicator pool covered student characteristics and intake quality, curriculum design, teaching staff, learning resources, practicum and workplace learning, and quality assurance, providing the basis for subsequent expert surveys.

3.1.2 Expert Delphi questionnaire

Based on the initial pool, an expert questionnaire on curriculum quality evaluation indicators for preschool education was developed. The Fuzzy Delphi Method (FDM) was used to conduct two rounds of expert appraisal of indicator importance. A 7-point fuzzy Likert scale was adopted (1 = extremely unimportant; 7 = extremely important), allowing experts to express judgements using triangular fuzzy numbers to better capture uncertainty in group opinions (Chu & Hwang, 2008). After each round, descriptive statistics were computed, including the mean importance

score, the full-score rate, and the coefficient of variation (CV), to examine convergence and dispersion. Kendall's coefficient of concordance (W) was also calculated to test inter-expert agreement and improve the objectivity of the consensus judgement. Indicators with relatively low mean importance and substantial disagreement (e.g., full-score rate < 20% and CV > 0.25) were treated as lacking consensus and were removed or revised for the next round. Internal consistency reliability was assessed, and Cronbach's alpha for Round 2 importance ratings reached 0.90, indicating strong reliability.

3.1.3 Data analysis and consensus assessment

During the Delphi analysis, a defuzzification procedure was applied to convert experts' triangular fuzzy ratings into crisp values, which were used to compute fuzzy consensus scores for each indicator. A consensus threshold of 0.70 was specified; indicators falling below this threshold were removed after the second round. Kendall's W was calculated to quantify the degree of coordination among expert ratings, and the Round 2 value was statistically significant ($p < 0.01$), suggesting that expert opinions converged. In addition, Fuzzy Analytic Hierarchy Process (FAHP) was employed to weight the retained indicators. Experts conducted pairwise comparisons across indicator levels to construct fuzzy judgement matrices, and consistency was verified ($CR < 0.10$). Chang's extent analysis method was then used to derive fuzzy weight vectors, yielding the relative weights of the indicators. Taken together, these instruments and procedures ensured a systematic development process and enhanced the reliability of the final indicator system.

3.2 Participants

The Delphi panel comprised 10 senior experts in preschool education with diverse yet relevant backgrounds, including four university-based specialists in preschool education, three experts from education administration or evaluation (e.g., supervisors or research officers), and three experienced kindergarten principals or frontline teachers. All panellists had professional training in preschool education and extensive practical experience; 80% had more than 10 years of professional practice, and 50% had over 20 years, indicating strong domain expertise. All invited experts completed both consultation rounds, resulting in a 100% response rate. The panel size followed established Delphi guidance that a group of at least 10 experts can minimise group error (Dalkey, 1969); moreover, when expert backgrounds are diverse, a panel of approximately 5–10 is commonly regarded as sufficient to ensure heterogeneity, whereas more homogeneous panels may be expanded to 15–30 (Clayton, 1997). The composition of this panel—covering technical, administrative, and practice-based experts—aligned with the Delphi requirement for diversity and provided a robust basis for indicator judgement.

3.3 Refining the indicator system using the Fuzzy Delphi Method

Building on the initial pool, two rounds of FDM consultation were conducted to refine and screen indicators. Experts provided fuzzy importance ratings for each candidate indicator using the 7-point fuzzy Likert scale (from extremely unimportant to extremely important), which introduced controlled fuzziness to reflect uncertainty in expert judgement. Compared with the conventional Delphi approach, FDM permits experts to express assessments using triangular fuzzy num-

bers, thereby capturing the vagueness inherent in human appraisal and facilitating consensus formation (Chu & Hwang, 2008). After each round, fuzzy means and consensus values were calculated, and indicators were retained or removed based on a pre-specified threshold (0.70). Indicators below the threshold and with substantial disagreement were eliminated or revised, while new indicators proposed by experts were incorporated into the second-round questionnaire. Across two rounds, expert opinions increasingly converged, and the final hierarchical structure of the curriculum quality evaluation indicators was established (see Section 4 for the final system).

3.4 Weighting indicators using Fuzzy Analytic Hierarchy Process

After indicator screening, FAHP was applied to determine the relative importance of retained indicators. First, a hierarchical structure was constructed, decomposing curriculum quality evaluation into a goal level, a criterion level (first-level indicators), and an indicator level (second-level indicators), with third-level indicators serving as operational measurement points. Experts then compared indicators pairwise using triangular fuzzy numbers based on the Saaty 1–9 scale to represent preference intensity (Chang, 1996). Fuzzy judgement matrices were formed and tested for consistency; all matrices satisfied $CR < 0.10$, indicating acceptable consistency. Chang's extent analysis method was subsequently used to solve the fuzzy matrices and derive weight vectors. Global weights for third-level indicators were obtained by multiplying local weights across levels. The resulting weights provided an evidence-based importance ranking to support subsequent comprehensive evaluation.

3.5 Validating the standards through Fuzzy Comprehensive Evaluation

To examine the practical utility of the proposed standards, Fuzzy Comprehensive Evaluation (FCE) was conducted with two higher vocational colleges in Guizhou Province that offer preschool education programmes (hereafter, Institution A and Institution B). Quantitative data for relevant indicators (e.g., student performance and faculty structure) were collected, and the expert panel rated qualitative indicators against the standards. Indicator data were transformed into fuzzy appraisal values to form fuzzy evaluation matrices, and comprehensive scores were computed for each institution at both dimension and overall levels. The procedure integrated FAHP-derived weights and experts' fuzzy appraisals to provide a holistic, quantified assessment of programme curriculum quality. Finally, the evaluation outcomes were compared with the institutions' observable programme standing (e.g., provincial ranking and social reputation) to examine the standards' validity and discriminant capacity.

4. Results

4.1 Preliminary development of the indicator framework

Drawing on the literature review and focus-group findings, this research preliminarily developed a three-level framework for evaluating curriculum quality in preschool education programmes. At the first level, five core domains were identified in line with vocational education training objectives and the disciplinary characteristics of preschool education: (1) quality of talent cultivation, (2) faculty and resources, (3) scientific research, (4) social service and reputation, and (5) quality assurance. At the second level, approximately 15 indicators were extracted to further

operationalise these domains. Each second-level indicator was further decomposed into measurable third-level indicators as observable evaluation points. The preliminary framework contained about 46 third-level indicators, covering key inputs, processes, and outcomes of curriculum delivery in higher vocational preschool education. This initial framework provided a foundation for expert consultation, while further refinement was required to enhance completeness and contextual fit.

4.2 Analysis of expert questionnaire results

In Round 1 of the Delphi consultation, experts scored the preliminary indicator system and provided revision suggestions. Overall, most indicators were rated as important, with mean importance scores for third-level indicators ranging from 5.0 to 7.0 on a 7-point scale. However, a small number of indicators exhibited notable disagreement, reflected in CV values above 0.25.

Some experts also recommended adding indicators that were not yet included (e.g., teachers' professional development; outcomes such as graduate employment). Based on Round 1 feedback, the research team revised the system by removing indicators with relatively low importance and high controversy, adding four new indicators, and rewording items that were unclear.

In Round 2, the revised indicator system was re-evaluated. Statistical results indicated that mean importance scores generally increased, CV values decreased, and expert opinions became more concentrated. The consistency test showed Kendall's $W = 0.32$ ($p < 0.01$), indicating a higher level of consensus. Table 2 presents selected Round 2 statistics, including mean importance, full-score rate, and CV. Most indicators met the predefined consensus criteria and were retained, while indicators failing to meet these criteria were removed.

Table 2 Descriptive statistics for selected indicators in Round 2 Delphi consultation

Indicator code	Indicator name	Mean importance	Full-score rate	CV	Decision
A-1-1	Entry score of newly admitted students	6.6	70%	0.10	Retain
A-1-2	Admission/enrolment rate	6.4	60%	0.12	Retain
A-2-2	Rationality of curriculum structure	6.1	50%	0.15	Retain
A-2-4	Suitability of curriculum content	5.0	10%	0.30	Delete

Note. The values are presented as examples in the manuscript; the indicator "Suitability of curriculum content (A-2-4)" did not meet the Round 2 consensus criteria and was removed.

4.3 Indicator screening results using FDM

After two rounds of FDM consultation, the initial indicator system was screened and finalised. Based on defuzzified comprehensive scores, each indicator was evaluated against the predefined threshold of 0.70. In total, seven initial third-level indicators were removed due to low scores and dispersed opinions; additional indicators suggested by experts were incorporated to strengthen completeness. The final system comprised five first-level indicators and 13 second-level indicators, with 39 third-level indicators.

FAHP was subsequently applied to calculate indicator weights. Table 3 summarises the global weights of indicators at each level. At the first level, "scientific research" received the

highest weight (0.25). Weight patterns at the second level further differentiated the relative contributions of specific components (e.g., within "scientific research", "teaching research and achievements" was weighted higher than "research capacity supporting teaching").

Table 3 Global weights of indicators in the final evaluation system

Indicator	Weight	Indicator	Weight
A Quality of talent cultivation	0.22	C Scientific research	0.25
A-1 Student intake quality	0.08	C-1 Teaching research and outputs	0.15
A-2 Curriculum design	0.07	C-2 Research capacity supporting teaching	0.10
A-3 Curriculum implementation	0.04	D Social service and reputation	0.15
A-4 Curriculum evaluation	0.03	D-1 School–enterprise collaboration	0.10
B Faculty and resources	0.18	D-2 Community engagement and professional reputation	0.05
B-1 Faculty structure and competence	0.09	E Quality assurance	0.20
B-2 Practicum teaching conditions	0.05	E-1 Internal quality assurance mechanisms	0.12
B-3 Teaching facilities and digitalisation level	0.04	E-2 External evaluation and improvement mechanisms	0.08

4.4 Curriculum quality evaluation standards system for preschool education programmes

Integrating the procedures above, the final curriculum quality evaluation standards system for higher vocational preschool education programmes was structured into three levels, including five first-level domains, 13 second-level indicators, and 39 third-level indicators. Table 4 presents the hierarchical structure and indicator content of the standards system. The system captures key inputs, processes, and outputs of programme quality while incorporating digitalisation-related indicators (e.g., smart classrooms and digital learning resources) and outcome-oriented indicators (e.g., graduate employment), thereby reflecting the evolving meaning of curriculum quality in the digital era.

Table 4 Framework of curriculum quality evaluation standards for preschool education programmes in higher vocational colleges

First-level domain	Second-level indicator	Third-level indicators
A Training Outcomes	A-1 Student intake quality	A-1-1 Entrance academic performance A-1-2 Admission (enrolment) rate A-1-3 Student origin structure
A Training Outcomes	A-2 Curriculum design	A-2-1 Proportion of core courses A-2-2 Appropriateness of curriculum structure A-2-3 Frequency of curriculum content updates
A Training Outcomes	A-3 Curriculum implementation	A-3-1 Diversity of teaching methods A-3-2 Proportion of practice-based teaching A-3-3 Proportion of blended (online–offline) teaching
A Training Outcomes	A-4 Curriculum assessment	A-4-1 Multiple assessment approaches A-4-2 Student evaluation mechanisms A-4-3 Feedback and use of assessment results
B Faculty Team and Resources	B-1 Faculty structure and capacity	B-1-1 Proportion of specialist-course teachers

First-level domain	Second-level indicator	Third-level indicators
B Faculty Team and Resources	B-2 Practice teaching conditions	B-1-2 Faculty qualification levels B-1-3 Industry/practice experience of faculty B-2-1 Number of practicum/training bases B-2-2 Duration of practice teaching B-2-3 Provision of training resources
B Faculty Team and Resources	B-3 Facilities and digital teaching capacity	B-3-1 Coverage of smart classrooms B-3-2 Degree of learning platform utilisation B-3-3 Level of digitisation of teaching resources
C Research	C-1 Teaching research and outputs	C-1-1 Number of funded teaching-reform projects C-1-2 Number of published papers C-1-3 Number of teaching awards
C Research	C-2 Research-to-teaching capacity	C-2-1 Rate of research-to-practice translation C-2-2 Faculty–student ratio for research participation C-2-3 Mechanisms whereby research supports curriculum renewal
D Social Service and Reputation	D-1 School–industry collaboration	D-1-1 Number of external internship partners D-1-2 Completeness of collaboration agreements D-1-3 Proportion of courses with industry mentors
D Social Service and Reputation	D-2 Community engagement and professional reputation	D-2-1 Number of community service projects D-2-2 Feedback from the industry/professional field D-2-3 Graduate employment satisfaction
E Quality Assurance	E-1 Internal quality assurance mechanisms	E-1-1 Frequency of teaching supervision E-1-2 Completeness of internal evaluation system E-1-3 Frequency of quality monitoring
E Quality Assurance	E-2 External evaluation and improvement mechanisms	E-2-1 Frequency of third-party evaluation E-2-2 Implementation rate of improvement plans E-2-3 Records and feedback mechanisms for continuous improvement

Note: In the table, indicator codes "A" through "E" represent primary indicators, and the numbers after "-" represent secondary and tertiary indicator codes, respectively.

This evaluation indicator system balances macro-policy guidance with practical operability, covering key aspects from student recruitment to teaching management, from faculty to research and social services, reflecting the core requirements for cultivating preschool education professionals in higher vocational colleges. By establishing a systematic and scientific indicator framework, it provides guidance for higher vocational colleges to conduct self-diagnosis and continuous

improvement and also provides an evaluation tool foundation for education authorities to supervise the quality of preschool education courses. Notably, this system introduces information technology indicators (such as smart classrooms and digital resources) and output-oriented indicators (such as graduate employment rate) to reflect the new connotations of preschool education course quality in the new era. Overall, the constructed indicator system is clearly structured, comprehensive, and highly applicable.

4.5 Practical application and validation

To examine the effectiveness of the standards system, this research applied FCE to two higher vocational colleges in Guizhou Province (Institution A and Institution B). Institution A achieved a substantially higher overall score than Institution B (0.6647 vs. 0.4916). Institution A scored higher on both the qualitative component (0.2579 vs. 0.2310) and the quantitative component (0.4068 vs. 0.2606). In practice, Institution A is recognised as one of the stronger programmes within the province, whereas Institution B ranks relatively lower. The evaluation results were broadly consistent with these observable differences, indicating that the proposed standards system can discriminate between programmes of different quality levels.

Table 5 Comparison of evaluation results between two institutions

Evaluation dimension	Institution A	Institution B
Composite score (qualitative indicators)	0.2579	0.2310
Composite score (quantitative indicators)	0.4068	0.2606
Overall composite score	0.6647	0.4916

Table 5 compares the scoring results of two higher vocational colleges in Guizhou Province under the quality evaluation criteria of this study. College A scored significantly higher than College B in both qualitative and quantitative indicators, resulting in a significant difference in the final comprehensive score. This aligns with the gap in the actual educational levels of the two colleges, validating the discriminant validity of the evaluation criteria system. In conclusion, the preschool education curriculum quality evaluation criteria system constructed in this study demonstrates good applicability and reliability in practice, providing a powerful tool for quality monitoring and improvement of preschool education programs in higher vocational colleges.

5. Discussion

5.1 Addressing the lack of dedicated standards for higher vocational preschool education

The curriculum quality evaluation standards developed in this research help address the lack of dedicated standards for preschool education programmes in higher vocational colleges (Ahmadian et al., 2021). Compared with approaches that directly transfer undergraduate-oriented indicators (Mou & Ding, 2020), the proposed framework takes into account the distinctive needs of vocational education and the professional features of preschool teacher education. It covers the key stages and components of programme delivery, from student intake to teaching management, and from faculty development to research and social service, thereby offering a coherent and comprehensive reference for quality enhancement.

5.2 Strengthening scientific grounding through an integrated theoretical lens

The framework integrates Fourth Generation Evaluation, OBE, and the PDCA cycle (Guba & Lincoln, 1989; Davis & Harden, 1999; Deming, 1986). Fourth Generation Evaluation highlights stakeholder participation, enabling the standards-development process to incorporate perspectives from frontline teachers, institutional leaders, and other relevant parties (Donaldson & Preston, 1995), which enhances fairness and usability. OBE ensures that the standards remain focused on training outcomes and learner development, emphasising evidence of competence development in preschool teacher preparation. PDCA supports continuous improvement by embedding feedback and adjustment mechanisms within implementation, thereby facilitating iterative quality enhancement.

5.3 Methodological contribution: integrating fuzzy methods for standards development and validation

This research combines FDM, FAHP, and FCE to overcome limitations associated with single method approaches and to integrate expert judgement with quantitative modelling. FDM supports consensus-based indicator selection, FAHP provides a structured basis for weighting, and FCE enables contextual validation in authentic institutional settings. Using fuzzy methods is particularly valuable in educational evaluation because they can better accommodate uncertainty and ambiguity in expert judgements and empirical data, thereby improving the robustness of evaluation conclusions (Chu & Hwang, 2008; Chang, 1996).

5.4 Practical implications and policy relevance

The establishment and validation of the standards offer practical implications for quality monitoring in higher vocational education. At the institutional level, colleges can use the framework to diagnose weaknesses and implement targeted improvements in curriculum design, faculty development, teaching management, and practicum arrangements, consistent with the national agenda for high-quality vocational education development (General Office of the CPC Central Committee & State Council, 2021). At the system level, the framework illustrates a pathway towards digitalised quality evaluation: by integrating qualitative and quantitative indicators within a comprehensive model and using information technologies for data collection and analysis, institutions and authorities can move towards dynamic monitoring, feedback, and continuous improvement.

5.5 Limitations and future directions

This research has limitations. First, the standards were developed based on evidence from Guizhou Province; while the framework has broader relevance, its application in other regions may require contextual adaptation. Second, the validation stage involved only two institutions, which limits generalisability. Future research could extend the application to a larger number of institutions and regions to further examine and refine the reliability and validity of the standards system. In addition, as preschool education and vocational education continue to evolve, standards should be updated iteratively to reflect emerging requirements. Future work could leverage big data and intelligent assessment technologies to support ongoing optimisation and to develop a digital, dynamic quality monitoring and improvement mechanism.

6. Conclusion

Responding to the development needs of preschool education programmes in higher vocational colleges in the digital era, this research developed a systematic set of curriculum quality evaluation standards and validated its effectiveness through Fuzzy Comprehensive Evaluation. Grounded in Fourth Generation Evaluation, Outcome-Based Education, and the PDCA cycle, the framework is organised into five first-level domains, thirteen second-level indicators, and thirty-nine third-level indicators. Through a sequential process of indicator consolidation via the Fuzzy Delphi Method, weighting via Fuzzy Analytic Hierarchy Process, and pilot evaluation in two institutions in Guizhou Province, the framework was shown to provide a comprehensive measure of programme quality and to distinguish institutional differences in a manner consistent with observable programme standing. In practice, the standards and the associated fuzzy evaluation procedures offer a useful tool for institutional self-evaluation and improvement, as well as a reference for education authorities in developing sectoral evaluation and accreditation guidelines. Future work should refine indicator definitions, accumulate multi-regional evidence, and explore big-data-enabled evaluation platforms to support real-time monitoring and continuous improvement of preschool teacher education quality in China.

AUTHOR CONTRIBUTIONS

Peng Yang: Conceptualization; research design; methodology; supervision; project administration; writing – review and editing. Xueye Zhang: Data collection; investigation; questionnaire administration/interview coordination; writing – original draft. Zhuofu Zhou: Formal analysis; data curation; statistical analysis; visualization; validation.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data generated and analyzed in this study are available from the corresponding author upon reasonable request. All data will be provided without undue restriction.

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