

Study on the Competency Components and Influencing Factors of “Double-Qualified” Teachers in Civil Construction Majors of Higher Vocational Colleges in Yunnan Province

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Abstract

This study aimed to explore the components and indicators of "double-qualified" teachers' competencies in civil construction programs at higher vocational colleges in Yunnan Province, assess the current competency levels and variations across demographic and professional profiles, and identify key factors influencing competency development. A sample of 202 teachers from 17 public institutions was selected through snowball sampling to ensure diversity in institutional type, teaching experience, and professional background. Data were collected via a validated structured questionnaire with high internal consistency (Cronbach's $\alpha > 0.90$) and analyzed using descriptive statistics, t-tests, one-way ANOVA, and content analysis. The results revealed that the competency framework consisted of four dimensions—professional knowledge, vocational skills, IT literacy, and professional attitude—with professional knowledge and vocational skills being the highest-rated areas, while IT literacy scored the lowest, indicating an imbalance in competency development. No significant differences were found in competency levels based on gender, age, or educational background. However, industry training participation and school-enterprise cooperation were positively correlated with higher scores in vocational skills and information literacy. Additionally, policy support at both provincial and institutional levels was identified as a key enabler across all competency domains, with industry training being the strongest predictor of vocational skills and school-enterprise cooperation the most influential factor for enhancing information literacy. These findings provided a solid evidence base for designing targeted

professional development strategies and policy interventions to strengthen the competency profiles of "double-qualified" teachers in civil construction fields.

Keywords: Double-Qualified Teachers; Civil Construction; Vocational Education; Competency Framework; Influencing Factors

Introduction

In recent years, China's vocational education system has undergone significant reform and upgrading, with "Double-qualified" teachers—those who combine solid theoretical knowledge with extensive industry experience—playing a key role in bridging the gap between academic teaching and real-world professional demands (Cheng et al., 2024; Xu & Li, 2021). National policies, such as the Opinions on Promoting the High-Quality Development of Vocational Education and the Vocational Education Law, have emphasized the urgent need to cultivate such teachers to improve teaching quality and align educational outcomes with industrial development (Beh & Fan, 2024).

In Yunnan Province, the civil construction sector has become a major driver of economic growth, with a total output value of 816.865 billion yuan in 2022. The sector is rapidly transitioning towards green building and digital construction technologies. Despite its importance, there is a lack of empirical research on the competency components and influencing factors for "Double-qualified" teachers in this field, particularly in the context of Yunnan, where certification standards remain unlocalized (Bi et al., 2024). Existing studies have mainly addressed general teacher competencies or national frameworks, leaving a significant gap in understanding the specific needs of vocational educators in Yunnan's civil construction programs.

This study focuses on "Double-qualified" teachers in civil construction programs at higher vocational colleges in Yunnan Province. These teachers play a vital role in integrating theory with practice, developing students' professional skills, and supporting the province's industrial transformation. With extensive experience as a "Double-qualified" teacher, the author has access to institutional insights and professional networks that inform the research. By 2023, there were 409 such teachers across 17 public vocational colleges in Yunnan. However, competency levels vary, and the absence of standardized provincial evaluation criteria hinders the alignment of teaching quality with industry demands.

This study therefore aims to (1) identify the components and indicators of competency for “Double-qualified” teachers in higher vocational colleges and (2) analyze the factors influencing these competencies within Yunnan’s civil construction programs. Using a mixed-methods approach, the research combines literature review, in-depth interviews, and questionnaire surveys with teachers from 17 public colleges. By systematically examining competency structures and influencing factors, the study aims to provide evidence-based insights that contribute to both academic discourse on teacher competency modeling and practical recommendations for enhancing the professional development and performance of “Double-qualified” teachers in Yunnan’s civil construction sector.

Research Objectives

1. To identify the components and indicators of “Double-qualified” teachers’ competency. This objective aims to deconstruct the concept of teacher competency into measurable dimensions and specific behavioral indicators. These indicators will reflect the integrated requirements of professional knowledge, vocational skills, information technology literacy, and professional attitude. The identification process will be grounded in a synthesis of relevant theories, policy frameworks, and empirical evidence collected from both educational and industry contexts.

2. To analyze the current status of competency and the influencing factors. This objective focuses on empirically assessing the current competency levels of the target teacher group. It also involves a systematic examination of the internal and external factors—such as policy support, industry training experience, and enterprise cooperation—that significantly influence competency development. The analysis will use quantitative and qualitative data to determine the extent and direction of these influences, providing a foundation for targeted interventions.

3. To generate a robust empirical basis for subsequent development. Through achieving the first two objectives, the study seeks to create a solid foundation for subsequent competency model construction and strategic planning. This ensures that teacher development initiatives in Yunnan’s higher vocational colleges are both evidence-based and contextually relevant.

Literature Review

Competency Theory and Its Evolution

The concept of “competency” emerged from management science and psychology, with McClelland's critique of traditional intelligence testing. In *Testing for Competence Rather Than for Intelligence*, McClelland (1973) argued that performance predictors should focus on underlying traits—knowledge, skills, motives, and self-concepts—directly linked to job success. This perspective laid the foundation for competency modeling in human resource development. Boyatzis further expanded this by presenting competencies as a holistic profile combining knowledge, behavioral capabilities, and values. Spencer formalized a model by introducing a behavioral event interview method, mapping observable behaviors to core competencies, a model that remains influential in both organizational psychology and education.

In China, competency theory was introduced in the early 1980s alongside Western frameworks in vocational training. Conchado (2015) conceptualized competencies as a blend of knowledge, skills, and values tied to superior performance, while Koo and Miner (2010) emphasized their measurability and application in workforce development. Despite the development of these frameworks, existing studies have primarily focused on corporate management, with limited application to specialized vocational education contexts (Chen et al., 2012). This gap underscores the need for research that adapts competency models to the specific needs of vocational educators.

Teacher Competency in Vocational Education

Teacher competency in vocational education combines academic knowledge with practical industry experience. International frameworks, such as OECD's Teaching and Learning International Survey and UNESCO's guidelines for technical and vocational education, define effective vocational teachers as those who integrate subject expertise with teaching methodology, industry engagement, and adaptability to technological change.

In China, the Ministry of Education's Vocational College Teachers' Quality Improvement Plan (2021–2025) and the Guidelines for “Double-qualified” Teachers in Vocational Education emphasize the importance of vocational educators maintaining both pedagogical proficiency and industry expertise, with involvement in enterprise projects and skill competitions. Research has demonstrated that “Double-qualified” teachers are essential in bridging the gap between classroom theory and industry practice (Chan & Lee, 2023). Their competencies extend beyond professional knowledge and teaching skills to include IT literacy and professional attitudes,

essential for integrating emerging industry standards such as BIM and green building norms into curricula.

Despite the growing body of research, much of the existing literature remains fragmented, with a focus on policy analysis or broad competency domains, rather than providing an empirically validated competency structure for specific disciplines (Luo & He, 2021). The civil construction sector, a critical area in vocational education, is particularly underrepresented in this research, despite its strategic importance to local economies.

Research on “Double-qualified” Teachers in Civil Construction Majors

The civil construction sector in Yunnan Province is a dynamic industry, with a total output of 816.865 billion yuan in 2022. This growth is driven by a shift towards intelligent construction technologies, green building practices, and digital project management systems such as BIM. These developments create new competency demands for vocational educators, especially for those teaching civil construction majors in higher vocational colleges.

However, institutional practices have lagged behind these industry shifts. The Yunnan Provincial Civil Construction Categories Teaching Steering Committee notes that teacher recruitment and certification processes are based on national academic standards, which do not reflect the specific industrial characteristics of the province. This has resulted in competency disparities among teachers, as well as a lack of mechanisms to evaluate practical industry experience or enterprise collaboration.

Previous research on vocational teacher competency in China has rarely addressed the factors that influence competency development in the civil construction field. While some studies in other provinces suggest that policy support, industry training, and school–enterprise cooperation play a significant role in shaping teacher competency, these findings have not been validated in Yunnan’s unique geographic, economic, and institutional context. This gap highlights the need for research tailored to the provincial context, which could provide a robust evidence base for designing professional development programs and reforming certification systems.

The existing literature provides theoretical foundations for competency and outlines general competencies for vocational educators, emphasizing the role of policy in developing “Double-qualified” teachers. However, it leaves a clear gap in terms of an empirically grounded, discipline-specific competency framework for civil construction teachers in Yunnan. This study aims to address that gap by adapting competency models to the context of vocational education in Yunnan Province. By integrating policy directives, industry trends, and local data, the study will identify the

core competencies required for “Double-qualified” teachers in civil construction programs and analyze the key factors influencing their development, such as policy support, industry training, and school-enterprise cooperation. The outcomes will contribute both to the academic discourse on competency modeling and to practical recommendations for improving teacher quality in alignment with Yunnan’s economic transformation.

Conceptual Framework

This research is an empirical study that explores the competency profile of “Double-qualified” teachers in the civil construction categories of higher vocational colleges in Yunnan Province. The study focuses on identifying key competency components and analyzing the factors that influence their development. The conceptual framework is grounded in McClelland’s competency theory, which emphasizes measurable attributes—knowledge, skills, motives, and traits—that differentiate high performers. This framework is further informed by vocational teacher professional development theory and relevant Chinese vocational education policies.

The framework proposes that the competency level of “Double-qualified” teachers is shaped by several external and experiential factors. We hypothesize that these factors influence the teachers’ competency levels across four key dimensions: professional knowledge, vocational skills, IT literacy, and professional attitude and motivation.

This framework guides the study in systematically identifying the competency components of “Double-qualified” teachers and testing how policy, training, and industry collaboration influence their competency development. The findings are expected to provide evidence-based recommendations for optimizing teacher development policies and practices, ultimately improving the quality of vocational education in Yunnan’s civil construction programs.

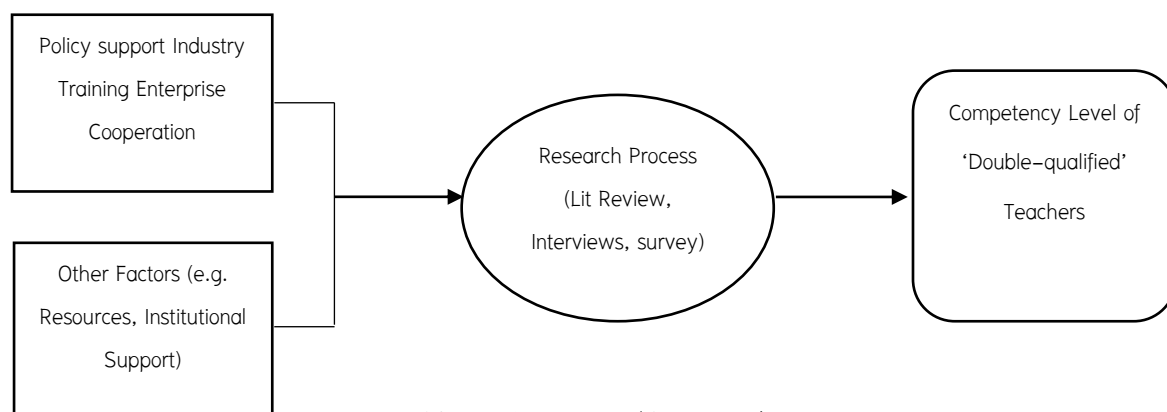


Figure 1 Conceptual Framework

Research Methodology

This study employed a mixed-methods research design to investigate the competency components and influencing factors of “Double-qualified” teachers in the civil construction categories of higher vocational colleges in Yunnan Province. By integrating both qualitative and quantitative approaches, the research ensured a comprehensive analysis, enabling the triangulation of findings to enhance the validity and reliability of the results.

1. Research Design

The research was conducted in two sequential phases:

Phase 1 (Qualitative): The study began with an extensive literature review to synthesize existing theories and empirical findings related to teacher competency in vocational education. Following this, semi-structured interviews were conducted with senior administrators, industry experts, and experienced “Double-qualified” teachers. The goal of these interviews was to identify the structural components and specific indicators of teacher competency in the civil construction field.

Phase 2 (Quantitative): Based on the findings from Phase 1, a cross-sectional survey was conducted to quantitatively measure the current competency levels of “Double-qualified” teachers and to analyze the relationships between influencing factors and competency dimensions.

2. Population and Sampling

The research population comprised “Double-qualified” teachers in civil construction majors from 17 public higher vocational colleges in Yunnan Province.

Qualitative Phase: Purposive sampling was employed to select 17 participants with substantial teaching and industry experience, ensuring that expert opinions were representative of the key issues in the field.

Quantitative Phase: Snowball sampling was adopted to ensure diversity across institutions and teaching contexts. While this method may limit generalizability due to the non-random nature of the sampling, it was necessary to ensure the inclusion of a broad range of participants who may otherwise be hard to reach. Snowball sampling allowed for a more diverse and representative sample of teachers across different colleges and backgrounds.

A total of 210 questionnaires were distributed between March and May 2024, all of which were returned. After data screening, 202 questionnaires were deemed valid, yielding an effective recovery rate of 96.19%.

3. Research Instruments

Two main instruments were used in the study:

Interview Protocol: Developed based on competency theory (Boyatzis, 1982; Spencer & Spencer, 1993), national policy documents, and prior empirical research, the protocol covered competency dimensions, skill requirements, and perceived challenges in professional practice.

Structured Questionnaire: The questionnaire was divided into three sections:

Demographic and professional background (e.g., age, gender, education level, years of teaching, industry work experience).

Competency assessment, using a five-point Likert scale to assess professional knowledge, vocational skills, IT literacy, and professional attitude.

Influencing factors, including policy support, industry training experience, and enterprise cooperation.

The questionnaire underwent expert validation by five specialists in vocational education and construction engineering. Additionally, a pilot test with 30 respondents was conducted. Reliability analysis revealed a high internal consistency with Cronbach's $\alpha = 0.873$, indicating that the instrument is highly reliable for measuring the intended constructs.

4. Data Collection Procedures

Qualitative Data: Interviews were conducted both face-to-face and online in February 2024, with prior informed consent obtained from all participants. The interviews were audio-recorded for accurate transcription and analysis.

Quantitative Data: The questionnaires were distributed via the Wenjuanxing online platform and in paper-based formats between March and May 2024. Participation was voluntary, and respondents were informed of the study's purpose, their right to confidentiality, and the voluntary nature of their participation.

5. Data Analysis

Qualitative Data: The qualitative data were analyzed using thematic analysis (Braun & Clarke, 2019) to extract recurring themes and competency indicators. NVivo 12 software was used to assist in coding and categorizing the data.

Quantitative Data: Quantitative data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize demographic characteristics and competency levels. T-tests, ANOVA, and multiple regression analysis were employed to examine the relationships between

influencing factors and competency dimensions. The results of the regression analysis identified the predictors of competency levels, with statistical significance set at $p < 0.05$.

6. Ethical Considerations

This study adhered to strict ethical principles, including voluntary participation, informed consent, confidentiality, and data protection. Approval was obtained from the Academic Ethics Committee of [Your Institution] prior to data collection. All participants were informed of their right to withdraw from the study at any time without penalty. To ensure privacy, all data were anonymized before analysis.

Research Results

To identify the components and indicators of “Double-qualified” teachers’ competency in higher vocational colleges

The exploratory factor analysis identified four core competency dimensions for “Double – qualified” teachers in civil construction categories: Professional Knowledge, Vocational Skills, Information Literacy, and Professional Attitude. Each dimension comprised specific indicators that align with both national vocational education competency frameworks and industry expectations. Descriptive statistics showed that Professional Knowledge (Mean = 4.28, SD = 0.51) and Vocational Skills (Mean = 4.23, SD = 0.55) received the highest ratings, indicating that teachers generally possess strong subject expertise and practical ability. Professional Attitude (Mean = 4.15, SD = 0.58) also scored high, reflecting a strong sense of responsibility and commitment to teaching. In contrast, Information Literacy (Mean = 3.91, SD = 0.63) received comparatively lower ratings, suggesting a relative gap in integrating digital tools into instructional practice.

Table 1 presents the competency dimensions, their respective indicators, and descriptive statistics based on the sample size of 202 valid respondents.

Competency Dimension	Example Indicators	Mean	SD
Professional Knowledge	Mastery of core construction theory; Ability to apply technical standards	4.28	0.51
Vocational Skills	Proficiency in construction techniques; Ability to guide practical training	4.23	0.55
Information Literacy	Application of digital teaching tools; Integration of BIM technology	3.91	0.63
Professional Attitude	Commitment to teaching; Adherence to professional ethics	4.15	0.58

To analyze the “Double-qualified” teachers’ competency and factors related to the competency in the civil construction categories

Correlation and regression analyses revealed that Policy Support, Industry Training Experience, and School–Enterprise Cooperation were significantly and positively associated with all four competency dimensions ($p < 0.01$). Among these factors, Industry Training Experience showed the strongest predictive effect on Vocational Skills ($\beta = 0.412$, $p < 0.001$), indicating that teachers with more frequent and higher-quality industry engagement are better equipped with practical skills. School–Enterprise Cooperation had the most substantial effect on Information Literacy ($\beta = 0.385$, $p < 0.001$), suggesting that collaborative projects with enterprises foster the adoption of modern digital tools.

Demographic variables such as gender and age showed no statistically significant influence on any competency dimension, suggesting that institutional and professional development support are more central to competency growth than individual characteristics.

Table 2 summarizes the regression analysis results, including effect size measures (Cohen’s f^2), which provide additional insight into the magnitude of the effects:

Independent Variable	Professional Knowledge (β)	Vocational Skills (β)	Information Literacy (β)	Professional Attitude (β)
Policy Support	0.324** ($f^2 = 0.09$)	0.298** ($f^2 = 0.07$)	0.276** ($f^2 = 0.06$)	0.301** ($f^2 = 0.08$)
Industry Training Experience	0.375** ($f^2 = 0.12$)	0.412** ($f^2 = 0.17$)	0.341** ($f^2 = 0.10$)	0.329** ($f^2 = 0.09$)
School–Enterprise Cooperation	0.298** ($f^2 = 0.08$)	0.305** ($f^2 = 0.08$)	0.385** ($f^2 = 0.14$)	0.314** ($f^2 = 0.10$)
Gender	ns	ns	ns	ns
Age	ns	ns	ns	ns

*Note: * $p < 0.01$; ns = not significant

f^2 values represent the effect size, where values of 0.02, 0.15, and 0.35 correspond to small, medium, and large effects, respectively.

Discussions

Interpretation of Key Findings

This study empirically validates a multi-dimensional competency framework for "Double-qualified" civil construction teachers, identifying professional knowledge, vocational skills, information literacy, and professional attitude as core components. Three key findings emerge from our analysis.

First, the high proficiency in professional knowledge and vocational skills, strongly predicted by industry training experience, underscores the success of experiential learning approaches. This finding directly corroborates established competency theories (McClelland, 1973) and empirical work (Beh & Fan, 2024; Conchado, 2015; Koo & Miner, 2010;), confirming that hands-on, authentic industry engagement is the primary mechanism for translating theoretical knowledge into practical teaching capability.

Second, the identified deficit in information literacy reveals a critical gap in adapting to the industry's digital transformation. This challenge, noted in prior research (Hilarowicz et al., 2023), is notably mitigated by school-enterprise cooperation. Our finding that this factor is the strongest predictor of information literacy provides robust support for Lee's (2024) argument that digital competencies are best cultivated through authentic, collaborative projects with industry, rather than through conventional training alone.

Third, the cross-cutting positive influence of policy support on all competency dimensions highlights its role as a fundamental enabler. This aligns with institutional theories and recent findings (Wang et al., 2024), suggesting that well-structured policies provide the necessary resources and incentives for holistic competency development.

Theoretical and Practical Implications

Theoretically, this study refines the application of competency theory in a vocational education context. It demonstrates a "selective affordance" model where distinct contextual factors (industry training, enterprise cooperation, policy support) selectively enhance different competency dimensions, rather than having a uniform effect. This nuanced interplay between individual attributes and specific contextual opportunities advances our understanding of how vocational teacher competence is dynamically constructed.

Practically, the findings offer clear strategic directions for institutions in Yunnan and similar contexts: For Skills Development: Mandate structured, outcome-based industry attachments to sustain high levels of practical expertise; For Digital Competency: Prioritize "digitally anchored"

enterprise partnerships that co-deliver projects using tools like BIM, moving beyond simple software training; For Policy Implementation: Translate broad policy support into tangible mechanisms, including clear certification standards and competency-based evaluation and promotion systems.

Limitations and Future Research

This study has several limitations. Its cross-sectional design precludes definitive causal inferences. The reliance on self-reported data may introduce bias, and the focus on public colleges in a single region may affect generalizability.

Future research should employ longitudinal designs to establish causality and incorporate multi-source data (e.g., peer reviews, analysis of teaching artifacts) to enhance validity. Expanding the scope to include private institutions and diverse geographical contexts would improve the external validity of the findings and allow for insightful comparative studies.

Conclusion

This study identifies a four-factor competency structure for “Double-qualified” civil construction teachers in Yunnan. While teachers demonstrate strength in professional knowledge and vocational skills, a notable gap persists in information literacy. Findings reveal policy support enhances all competencies, industry training specifically builds vocational skills, and enterprise cooperation most effectively develops digital capabilities. To address these insights, institutions should strengthen industry attachments, foster digitally-focused collaborations, and implement supportive policy mechanisms to comprehensively advance teacher competency development.

New Knowledge from Research

Based on the empirical results, a conceptual model emerges where external factors—policy support, industry training, and school-enterprise cooperation—differentially shape the core competencies of “Double-qualified” teachers. Policy support acts as a cross-cutting enabler that elevates all competency dimensions; industry training serves as the primary driver for developing robust vocational skills; and school-enterprise cooperation specifically bridges the digital gap by strengthening information literacy. This configuration explains the observed outcome—a teaching workforce strong in disciplinary knowledge and practical skills, yet progressing in digital integration—and underscores that targeted institutional mechanisms, rather than demographic

factors, are the primary levers for cultivating a teaching force capable of meeting industrial and technological demands.

Suggestions

Provincial Policy and Governance Level

Based on correlational evidence, provincial education authorities are encouraged to establish a competency certification framework specifically designed for “Double-qualified” civil construction teachers in Yunnan. This framework should integrate the four identified competency dimensions—professional knowledge, vocational skills, digital literacy, and professional attitude—into a weighted evaluation system. This framework could be linked to promotion, training eligibility, and access to provincial research grants. Policies should consider mandating regular industry immersion periods, allowing teachers to participate in live construction projects and develop real-world teaching materials. Furthermore, initiatives targeting BIM applications, green building technologies, and digital construction should be launched, delivered jointly by universities and leading enterprises. This would ensure that teachers' competencies remain aligned with both national skill standards and Yunnan's evolving industrial needs.

Institutional Level

At the institutional level, higher vocational colleges should consider implementing a performance-based teacher development system that incorporates peer observation, student feedback, and digital teaching portfolios as key evaluation tools. Institutional policies might also recognize enterprise engagement, project-based learning, and digital resource creation as equivalent to conventional teaching hours, with financial incentives to support these activities. In addition, investing in technical infrastructure—such as standardizing BIM software tools, structural analysis tools, and construction management platforms, while maintaining shared digital repositories—could enhance teaching practices. Such measures, based on the study's findings, would embed the competency framework into institutional practice and support continuous professional growth.

Industry–University Collaboration Level

Based on the study's evidence, a structured “dual residency” program could be formalized, where teachers periodically work in partner enterprises, and enterprise experts are invited into colleges for co-teaching and curriculum co-design. Collaboration should prioritize embedding industry-standard tasks into coursework, with assessment rubrics co-developed by both academic

and industry stakeholders. Industry project deliverables—such as construction schedules, digital models, and quality control reports—could be adapted into reusable teaching modules. This approach would help deepen teachers' vocational expertise and directly transfer current industry practices into classroom learning, potentially narrowing the skill gap for students entering the workforce.

Individual Teacher Level

Based on correlational findings, teachers should adopt an evidence-based self-development approach, setting measurable goals across the four competency dimensions and documenting progress through reflective teaching journals and action research. Key areas for development should include obtaining certifications in BIM, project management, and green construction, as well as mastering emerging technologies relevant to civil construction. Teachers should also be encouraged to participate in interdisciplinary workshops to expand their teaching methodologies, applying these skills to design problem-based learning modules that reflect authentic construction scenarios. This continuous cycle of skill acquisition, application, and reflection could help ensure that teachers remain competitive and responsive to industry demands.

Monitoring and Continuous Improvement

To track competency development, a multi-source evaluation system could be implemented, combining quantitative performance indicators—such as the number of industry-engaged projects, student satisfaction scores, and digital resource outputs—with qualitative assessments from peers, administrators, and industry partners. Pilot programs in selected colleges may be used to refine the monitoring framework before scaling up across Yunnan. Annual evaluation cycles, based on evidence from these programs, could inform revised training programs and policy adjustments, ensuring that competency development remains dynamic, data-driven, and aligned with the evolving priorities of both the education sector and the construction industry.

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