ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

Research on the Training Direction and Job Competence of Students Majoring in Civil Engineering and Architecture in Vocational Colleges under the New Situation

Yutong Fu [1], Jingdong Zhou [1], Jie Deng [1], Yu Bai [2], Jing Jiang [3]

[1] Nanchong Vocational and Technical College, Nanchong, Sichuan, 637000, China

[2] Southwest Petroleum University, Nanchong, Sichuan, 637000, China

[3] Chengdu Xingjin Ecological Construction Investment Group Co., Ltd., Chengdu, Sichuan, 610041, China

Abstract

In the context of China's industrial upgrading and rapid development of the digital economy, the civil engineering industry is also facing transformation and upgrading. The contradiction between an oversupply of traditional vocational civil engineering talents and an insufficient supply of talents for new infrastructure positions has become increasingly prominent. Based on this, this paper proposes an employment-oriented adjustment strategy for the training direction of civil engineering and architecture: broadening the interdisciplinary knowledge system, optimizing redundant majors, strengthening modular courses for sustainable development positions, and developing industry cluster courses tailored to local conditions. At the same time, a work ability evaluation system based on the "problem-solving closed loop" has been constructed. It is hoped to provide theoretical basis and practical path for the educational reform of civil engineering and architecture in vocational colleges, and achieve effective alignment between talent supply and industrial upgrading.

Keywords

Civil engineering and architecture; Employment direction; Training direction; Job competency.

1. Introduction

Under the new circumstances of global political and economic changes and national policy adjustments, China's urban development has entered a new stage, profoundly affecting the civil engineering industry and the employment of vocational students majoring in civil engineering and architecture.

From the perspective of higher vocational education, among the top 20 majors with the highest number of professional programs cancelled or suspended in national higher vocational colleges in 2025, the category of civil engineering and architecture accounted for 20.3%, reflecting the contraction of traditional civil engineering fields. However, the employment rate of graduates in this major category is still higher than the average, but their job satisfaction is relatively low, and the professional relevance after three years of graduation is only 58% [1], indicating a significant mismatch between talent cultivation and industry demand.

From the perspective of industry development, the civil construction industry is undergoing structural changes. On the one hand, real estate investment continues to shrink; on the other hand, multiple new civil construction-related positions have emerged among the new occupations announced by the Ministry of Human Resources and Social Security in 2025 [2]. The added value of the construction industry reached 8.9949 trillion yuan in 2024 [3],

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

indicating that the total volume of the industry remains stable, and the focus of industry construction has shifted from new housing construction to the renovation of municipal service facilities and the construction of new infrastructure.

It is evident that the civil engineering and construction industry is currently in a pivotal period of transformation and upgrading, characterized by the contraction of traditional sectors and the emergence of new ones. The current talent cultivation model in higher vocational education deviates from the industry's development trajectory, necessitating urgent reform to achieve precise alignment between talent supply and industry demand.

2. Employment Development Direction for Vocational Civil Engineering and Architecture Students Under The New Situation

2.1. Employment Directions for Domestic Vocational Students Majoring in Civil Engineering and Architecture

According to the statistical bulletin for 2022-2024, apart from the construction and real estate industries, industries with an average annual growth rate of fixed assets investment exceeding 5% over the past three years include mining, manufacturing, electricity, heat, gas, and water production and supply, transportation, warehousing and postal services, information transmission, software and information technology services, scientific research and technical services, resident services, repairs, and other service industries. These industries correspond to key areas of China's future innovation-driven, green, low-carbon, and intelligent transformation. The infrastructure construction in these fields represents a new employment direction for civil engineering practitioners, transitioning from traditional real estate construction to the construction of new-quality productive infrastructure.

2.2. Employment Directions for Students Majoring in Civil Engineering and Architecture in Higher Vocational Education Abroad

For overseas civil engineering construction, the availability and improvement of infrastructure are the basic conditions for the realization of China's "the Belt and Road" strategy. Asia, Africa, and South America still have a strong demand for infrastructure construction, and civil engineering technical management personnel working overseas are mostly engaged in highway, railway, bridge engineering, and building construction engineering[4]. Higher vocational civil engineering students can prioritize learning and accumulating relevant knowledge and skills when considering employment abroad.

3. Redundant Positions and Sustainable Development Positions Within The Industry

3.1. Redundancy Warning Positions Within The Industry

The significant reduction in professional settings indicates a low degree of matching between the talents trained and those needed in the market, leading to poor employment rates. Comparing the professional point setting data from 2023 to 2025, there are 9 redundant warning majors with a reduction rate exceeding 20% or with the number of schools offering the major being in the single digits. These redundant majors and their corresponding main job positions are listed in Table 1:

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

Table 1. Redundant positions in industry early warning

No.	Name of higher vocational major	Corresponding to the main professional positions
1	Village and town construction and management	Urban and rural planning engineering technicians, civil engineering and construction engineering technicians
2	Building electrical engineering technology	Electrical engineering technician
3	Building electrical engineering technology	Project management engineering technicians
4	Informatization management of construction economy	Information management engineering and technical personnel
5	Construction engineering supervision	Supervision engineering technician
6	Construction engineering supervision	Environmental sanitation engineering technicians
7	Construction engineering supervision	Asset and resource appraisal professionals, business professionals, real estate intermediary service personnel, and other real estate service personnel
8	Industrial equipment installation engineering technology	Construction and installation personnel
9	Intelligent detection and valuation of real estate	Asset and resource appraisal professionals, building safety appraisal engineering technicians, and house inspectors

3.2. Sustainable Development Positions Within The Industry

Table 2. Sustainable Development Positions in Various Industries

No.	Name of higher vocational major	Corresponding to the main professional positions
1	Ancient architectural engineering technology	Ancient building construction personnel
2	Architectural animation technology	Building Information Modeling Technician
3	Smart city management technology	Construction engineering technicians, surveying and mapping and geographic information engineering technicians, software and information technology service personnel, other water conservancy, environmental and public facilities management service personnel, community and village staff
4	Intelligent construction technology	Construction engineering technician
5	Civil engineering testing technology	Construction engineering technician
6	Building fire protection technology	Fire engineering technicians, fire facility operators
7	Intelligent detection and maintenance of municipal pipe network	Construction engineering technician
8	Construction engineering technology	Construction engineering technicians, management (industrial) engineering technicians
9	Building decoration construction technology	Construction engineering technicians, professional design service personnel, building construction personnel, and architectural decoration personnel
10	construction cost	Engineering cost engineering technicians
11	Interior design of buildings	Interior decorator
12	/	Building Information Modeling Technician
13	/	Prefabricated building construction worker
14	/	Architectural curtain wall designer
15	/	Energy-saving and emission-reduction consultant for buildings
16	/	Decoration manager
17	/	Steel structure assembler

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

The increase in professional settings indicates an increased market demand for such talents. There are 7 existing professional settings showing a positive growth trend. Additionally, according to Max's employment data, there are 4 civil engineering and architecture majors that have maintained a top 30 employment ranking from 2023 to 2025. These 11 majors can be considered to have sustainable development potential within the industry.

In addition, since 2019, the Ministry of Human Resources and Social Security of China has successively released 7 batches, totaling 110 new occupations, among which 6 are directly related to civil engineering and construction. The released new occupations serve as a barometer for the upgrading and development of industries, and are also a reservoir for future new job opportunities, indicating their potential for sustainable development.

The list of the aforementioned 17 majors or new professions with sustainable development potential is presented in Table 2:

4. Current Status of Training Standards for Civil Engineering and Architecture Majors in Higher Vocational Colleges

4.1. Training Objectives

In the vocational education professional teaching standards updated in February 2025, the training objectives of various majors within the civil engineering and architecture category are primarily aimed at cultivating talents for small and medium-sized, district- and county-level engineering project construction. The focus of the training objectives for each major is on engineering technology itself, with insufficient emphasis on the setting of cross-disciplinary talent training objectives in the context of digitalization and intelligence [5].

4.2. Curriculum Setting

The curriculum is divided into public basic courses and professional courses. The professional courses include professional basic courses, professional core courses, and professional expansion courses. Currently, the professional basic courses such as architectural drawing, building materials, and BIM are reasonably configured; the professional core courses are in line with the existing training objectives; and the expansion courses cover topics such as big data, intelligent technology, and green building.

However, with the upgrading of domestic industries, the civil engineering industry has shifted from large-scale construction to providing customized infrastructure for new industries. At the same time, the "Belt and Road" initiative requires practitioners to possess the ability to handle technical and coordination issues in complex environments. The existing courses are still traditional and have not fully integrated new industries and new drivers of growth, lacking sufficient cross-disciplinarity, resulting in insufficient cultivation of students' ability to solve complex problems and difficulty in adapting to new industry demands.

4.3. Teacher Allocation

In terms of teacher allocation requirements, dedicated teachers and part-time teachers primarily focus on mid-to-senior level talents within their respective industries and majors, which can better ensure the quality of professional course instruction. This type of teaching staff enables professional course instructors to have a specialized and in-depth knowledge base in their respective majors, but they lack the ability to solve cross-industry, broad and flexible engineering problems.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

5. Suggestions for Adjusting The Employment-Oriented Training Direction of Civil Engineering And Architecture in Higher Vocational Education

5.1. Broaden Knowledge System

While consolidating professional foundations, students should be strengthened in general education on new social driving forces. According to the analysis of new professions released by the Ministry of Human Resources and Social Security, fields such as artificial intelligence, drones, intelligent manufacturing, and elderly care services are developing rapidly, driving engineering demands for new energy infrastructure, drone application scenarios, industrial plant renovation, and age-friendly construction. General education content related to these fields should be incorporated into teaching to broaden students' knowledge horizons. For students aiming for employment in the "Belt and Road" region, teaching content on the cultural environment and typical engineering cases of relevant countries should also be added.

5.2. Adjust Talent Cultivation for Redundant Early Warning Positions

For the nine early-warning majors with high attrition rates, their professional settings should be reduced or adjusted, or their training modes should be improved. Due to the continuous downturn in the real estate industry, the majors of Real Estate Operation and Management and Real Estate Intelligent Inspection and Appraisal should be reduced; due to the narrowing of the scope of mandatory supervision by the state, the market demand for supervision personnel has decreased, and the major of Construction Engineering Supervision should be reduced.

The majors of rural construction and management, building electrical engineering technology, construction engineering management, building economic information management, urban environmental engineering technology, and industrial equipment installation engineering technology should be reduced, or adjusted in combination with the transformation direction of greenization, industrialization, intelligence, and internationalization [6], and the professional course setting and training mode should be timely adjusted.

5.3. Develop and Optimize Curriculum Settings for Sustainable Development Positions

For the sustainable development major, it is necessary to establish a cross-disciplinary and integrated training model, continuously transitioning towards modular teaching focused on "Civil Engineering+" and "Architecture+" [7]. Integrate new technologies such as artificial intelligence, green low-carbon, and intelligent construction into adaptable knowledge modules, and effectively link them with practical engineering projects. At the same time, we should enhance our international perspective by introducing international engineering certification courses. For newly emerging professions, we should investigate market demand, strengthen relevant courses within existing majors, or develop new courses.

5.4. Develop Industrial Cluster Courses Tailored To Local Conditions

Currently, China boasts 66 national-level strategic new industrial clusters, 80 national-level advanced manufacturing clusters, and 205 national-level innovative industrial clusters. Universities should develop targeted courses centered around the characteristics of local industries. Schools can hire technical personnel from within the clusters to teach part-time, cultivating technical talents that are more aligned with regional needs and enhancing the quality and scale of employment.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

6. Competency Assessment of Vocational College Students for New Jobs

Higher vocational education primarily aims to cultivate technical management talents who can apply new technologies to solve small and medium-sized problems. With the transformation and upgrading of the civil construction industry and its integration across different sectors, emerging jobs are constantly emerging. Scientifically assessing the competency of higher vocational students for these jobs has become crucial in evaluating the quality of training, defining career ceilings, and optimizing training programs.

6.1. Principles of Job Competency Assessment

The evaluation of whether vocational civil engineering students are competent for new types of work content should adhere to the following principles: competency-oriented, real-life scenarios, and defined upper limits. The focus should shift from knowledge mastery to competency application, examining students' abilities to analyze and break down problems in real-life scenarios, select tools, and implement solutions. Assessment tasks should be closely related to "small and medium-sized problems" in industrial upgrading, and set reasonable thresholds to reflect the upper limits of vocational students' abilities, distinguishing them from the research and development design orientation of undergraduate education.

6.2. Constructing a New Work Ability Evaluation System Based on the "Problem-Solving Closed Loop"

To assess students' professional competency in the context of the transformation of the civil engineering industry and the integration of related industries, an evaluation system based on the "problem-solving closed loop" is constructed. This system follows the following four progressive steps:

(1) Deconstruction of work scenarios and mapping of knowledge modules: Through enterprise research and expert interviews, we sort out emerging job tasks such as BIM collaborative management and building energy consumption supervision, and clarify the interdisciplinary knowledge required for them.

(2) Diagnosis of interdisciplinary knowledge linking ability: Assess whether students can effectively link new knowledge modules with their existing professional knowledge.

(3) The construction and practical handling of a new type of engineering problem matrix transforms emerging tasks into simulated real-life problem scenarios, and constructs a problem matrix based on complexity and knowledge dimensions. Students independently handle the extracted problems to test their practical abilities.

(4) Evaluation of treatment effectiveness based on comprehensive indicators: Comprehensive evaluation is conducted from four dimensions: problem decomposition, tool utilization, process logic and efficiency, and solution effectiveness.

This system closely integrates industry needs with competency assessment, not only effectively assessing students' competencies, but also providing a scientific basis for dynamically optimizing courses and defining the upper limits of talent cultivation.

7. Conclusion

This article addresses the core issue of mismatch between the cultivation of civil engineering and architecture talents in higher vocational education and the needs of industrial upgrading. By analyzing industry data and the current state of training, it clarifies new employment directions for civil engineering both domestically and internationally, distinguishes between redundant and sustainable development positions, and proposes suggestions for adjusting the training program, including expanding interdisciplinary knowledge systems, optimizing redundant majors, developing modular courses, and industrial cluster courses. Additionally, a

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202512_8(12).0039

work ability evaluation system based on a "closed-loop problem-solving" approach is constructed. The research findings provide a reference path for higher vocational education reform. However, the quantitative analysis of skill requirements for emerging po sitions in this article is still insufficient and requires further deepening in subsequent research.

Acknowledgements

Fu Yutong (1994-), holds a master's degree, is a lecturer, a first-level construction engineer, and a supervision engineer. Her research direction is civil engineering teaching and construction management.

The 2025 annual project of the "14th Five-Year Plan" for social science research in Nanchong City (Project No.: NC25C108).

2025 annual planning project of the College Graduates Employment Association: Youth Project, Research on the Competence and Training Direction of Vocational College Students during the Transformation of the Civil Engineering Industry, Project No. GJXY2025Y068

References

[1] Max Institute. Employment Report of Chinese Higher Vocational Students in 2025 [M]. Social Sciences Academic Press, 2025.

[2] General Office of the Ministry of Human Resources and Social Security, General Office of the State Administration for Market Regulation, and Office of the National Bureau of Statistics. Notice on the Release of Occupational Information for Engineering and Technical Personnel in Inspection and Testing Management [EB/OL]. [2025-10-08]. https://www.mohrss.gov.cn/xxgk2020/fdzdgknr/rcrs_4225/jnrc/202507/t20250721_550249.html

[3] National Bureau of Statistics. Statistical Communiqué on the 2024 National Economic and Social Development of the People's Republic of China [EB/OL]. [2025-10-08]. https://www.stats.gov.cn/sj/zxfb/202502/t20250228_1958817.html

[4] Hu Zhinan, Xiao Yaojun, Feng Huaiping, et al. Construction of International Civil Engineering Curriculum System Based on the Survey of Ability Requirements for Overseas Engineering Talents [J]. Journal of Shijiazhuang Tiedao University (Social Science Edition), 2024, 18(4): 96-102.

[5] Cheng Hong, Fu Wenjing. Pathways to Enhancing Key Educational Capabilities in Civil Engineering and Architecture Vocational Colleges [J]. Journal of Jiangsu Architectural Vocational and Technical College, 2025, 25(1): 91-94.

[6] Mao Zhibing. Driving New Transformations in Civil Engineering Talent Cultivation Guided by Industry Transformation [J]. Architecture, 2025(6): 52-53.

[7] Fan Feng. Aiming for the Top and Seizing the Opportunity [J]. Architecture, 2025(06): 61-62.