

# *Research on the Teaching Reform of Civil Engineering in Private Colleges under the Background of Intelligent Construction—Taking Dianchi College of Yunnan University as an Example*

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**Abstract:** In the critical period of modernization transformation and development in China's construction industry, the cultivation of intelligent construction talents is still in the practical stage. Taking the cultivation of intelligent construction talents at Dianchi College of Yunnan University as an example, this article explores the teaching reform of local civil engineering majors guided by student employment.

## 1. Introduction

The construction industry is one of the main material production departments and leading industries in the social economy, but its information management and lean management capabilities are at a lower level compared to other key fields. McKinsey & Company's International Research Institute "Imagining the Digital Future of the Construction Industry" reports statistical analysis, and in the global ranking of digital indicators in organizational fields, the construction industry ranks last and second. The leapfrog development of the construction industry based on intelligent construction is a major issue and an opportunity for historical development.

Against the backdrop of high-quality and green development in China, with the arrival of the aging population in China, the total number of engineering and construction practitioners is gradually decreasing. The construction industry is transitioning from labor-intensive to technology-intensive, and traditional design methods, construction methods, and production paradigms need to be combined with strategic emerging technologies, ultimately forming an intelligent construction discipline that deeply integrates the construction industry, manufacturing industry, and information industry, as well as interdisciplinary integration. This is very necessary and imperative for China's strong country strategy.[1] However, the number of intelligent construction talents and knowledge system in China are far from meeting the requirements of rapid economic and social development, and there is a significant shortage of professional and composite talents in intelligent construction, which hinders China's rapid development process in the field of intelligent construction. Therefore, there is an urgent need to address the characteristics of the knowledge structure of intelligent construction technology, the professional attributes and training models of talent technology, and implement targeted intelligent construction technology talent shaping engineering projects.[2]

In Yunnan, there are complex geomorphological phenomena such as the longitudinal valley area in western Yunnan and the karst landform area in eastern Yunnan. In addition, natural disasters such as earthquakes, landslides, mudslides, and mountain floods are very frequent. The monitoring technology and construction strategy of construction projects in such environments are one of the research challenges in this field worldwide. Relying on cutting-edge intelligent construction technology to carry out scientific research and talent cultivation is an important measure to promote Yunnan Province's three development strategies of becoming a demonstration zone for national unity and progress, leading the way in ecological civilization construction, and facing the radiation center of South Asia and Southeast Asia.[3]

## **2. Reflection on the teaching of civil engineering in local private colleges under the background of intelligent construction**

Taking Dianchi College of Yunnan University as an example, the major of civil engineering at this stage is mainly to cultivate students to master the necessity of socialist social modernization, develop morally, intellectually, physically, aesthetically and industrially, grasp the principles and basic knowledge of civil engineering courses, get basic training of civil engineer, and have good theoretical foundation, thick theoretical knowledge, strong practical skills and independent innovation ability, High level composite talents suitable for contemporary construction informatization construction. Graduates should be able to meet the basic requirements of talent cultivation in the "national standards", possess a scientific worldview and correct outlook on life, have good professional ethics and dedication, have a good physical and psychological constitution, and be able to face challenges and setbacks optimistically; Possess an overall engineering project concept, grasp the development trends of this major, and integrate into market development.

In the context of intelligent construction, the teaching of civil engineering majors has shown new characteristics of shifting from professional orientation to industrial demand, from independent professional training to cross disciplinary integration, and from professional ability development to innovative collaborative education. However, the current teaching of civil engineering majors is facing practical difficulties such as the detachment of professional talent cultivation positioning from reality, outdated practical course system, insufficient information literacy, and a disconnect between talent supply and demand.

Higher vocational education should correctly guide students in employment, enhance their core competencies in key professions, and enhance their ability to adapt to society. Universities and enterprises should establish an information flow mechanism between them to ensure efficient communication of information, allowing students to have a deep understanding of the enterprise and grasp the trend of talent demand in the enterprise. Combining the local development needs of Yunnan, adjusting the positioning of talent cultivation, actively adapting to the needs of regional economic and social development, and cultivating excellent professional talents with strong social competitiveness are the needs of talent cultivation in the new era.

## **3. Exploring the cultivation of civil engineering talents in local private colleges under the background of intelligent construction**

### **3.1. Focusing on student development and employment, clarifying the positioning of professional upgrading, and innovating the concept of talent cultivation**

At present, there are not many specialized intelligent construction positions in the industry. Through research on relevant enterprises, it has been found that there are upgrades and changes in the demand for job talents. Students who master BIM modeling technology have become popular

talents. Under the trend of intelligent construction industry development, many positions in enterprises have high requirements for digital and information technology applications. On the basis of mastering the core competencies of existing positions, mastering the application of digital tools and platforms, and being able to use various new technologies, methods, and tools to solve the core business problems of existing positions, improving efficiency is fundamental. With the future development of the construction industry, new jobs in the field of intelligent construction will come one after another.

Therefore, in the process of revising the talent cultivation plan for the Civil Engineering major of Dianchi College, Yunnan University, based on student development, guided by student employment and local industry talent demand, a survey was conducted on local enterprises to meet the satisfaction and ability needs of civil engineering talent cultivation. 100% of the companies participating in the survey stated that if our school graduates master knowledge and abilities related to intelligent construction, they will consider accepting our school graduates in recruitment. In previous recruitment, large state-owned enterprises also showed a preference for students who master BIM technology, breaking the rules and hiring our school students, all of which indicate the market demand for intelligent construction talents.

In the face of market demand, the civil engineering specialty of Dianchi College of Yunnan University first aims at the market, integrates civil engineering - management - electronic information engineering - Internet of Things and other disciplines, breaks the barriers to discipline talent training, builds a multidisciplinary talent training model, and fully studies and judges the direction of transformation and upgrading of traditional industries. Facing the needs of the intelligent construction industry, we will stay at the forefront of disciplines such as the Internet of Things, big data, and artificial intelligence, guided by the big engineering concept of civil engineering talent cultivation, break through disciplinary barriers, and reform the curriculum and practical system.

### **3.2. Combining local regional characteristics, supplementing the intelligent construction part and reconstructing the curriculum system**

In 2018, Tongji University took the lead in opening the intelligent construction major in China. Currently, only one student has graduated from this major, so the cultivation of intelligent construction talents is still in the exploratory stage, and the cultivation of talents lags behind the demand for talents in this field, show in Figure 1.

(1) Build a multi-disciplinary flexible and configurable course group system based on professional application capabilities, and consolidate the theoretical foundation of students' practical innovation. Keep up with the application needs of emerging industries, explore the connotation of knowledge integration and intersection in relevant disciplines, and build a multi-disciplinary integrated three-dimensional and hierarchical teaching system. Promote the adjustment and integration of relevant professional content, and form a multi-level, flexible and configurable interdisciplinary characteristic course group. Expanding the pilot program of university division system, breaking down professional barriers, opening up interdisciplinary elective courses, recombining and optimizing from four aspects: general education, disciplines, majors, and personalized education, creating a new system to ensure comprehensive coverage, clear hierarchy, and prominent focus, from basic general education, specialized education to comprehensive innovation, and cultivating students' ability to comprehensively apply knowledge Ability to think and solve problems, as well as cultivate initial innovation skills.

(2) The three levels of abilities, namely basic ability, professional practice ability, and independent innovation ability, are gradually learning and building a systematic and hierarchical teaching system. Students construct basic logical thinking in civil engineering based on their learning of the basic

courses of the subject. Based on the study of the main courses of the major, grasp the principles and basic knowledge of civil engineering discipline, receive basic training as an engineer, and be capable of designing, constructing, and managing civil engineering facilities such as buildings, bridges, and roads; By studying the required courses of intelligent information technology, one can acquire basic abilities in information design, management, and organizational coordination. The entire training plan should allow students to experience the entire construction process from shallow to deep, from single to comprehensive, from simulation to innovation driven learning.

(3) Following the laws of talent cultivation, we will divide and cultivate students, with a career oriented approach, and encourage personalized development of students. The talent cultivation program of Dianchi College of Yunnan University is career oriented, with a curriculum group for housing construction, road and bridge courses, and intelligent construction courses. It broadens students' basic engineering perspectives and solves the problem of narrow professional adaptation for graduates. At the same time, strengthen students' guidance on career design and pay attention to the core knowledge and abilities of the position. Elective courses offer basic courses in subject application to help students who want to further deepen their studies improve their theory; According to the employment orientation of students, there are relevant knowledge and technology course groups and professional knowledge and technology courses, which help students establish connections between fragmented subject knowledge and enhance their ability to solve practical complex engineering problems through course groups. Transform the focus of talent cultivation from imparting knowledge to cultivating abilities.

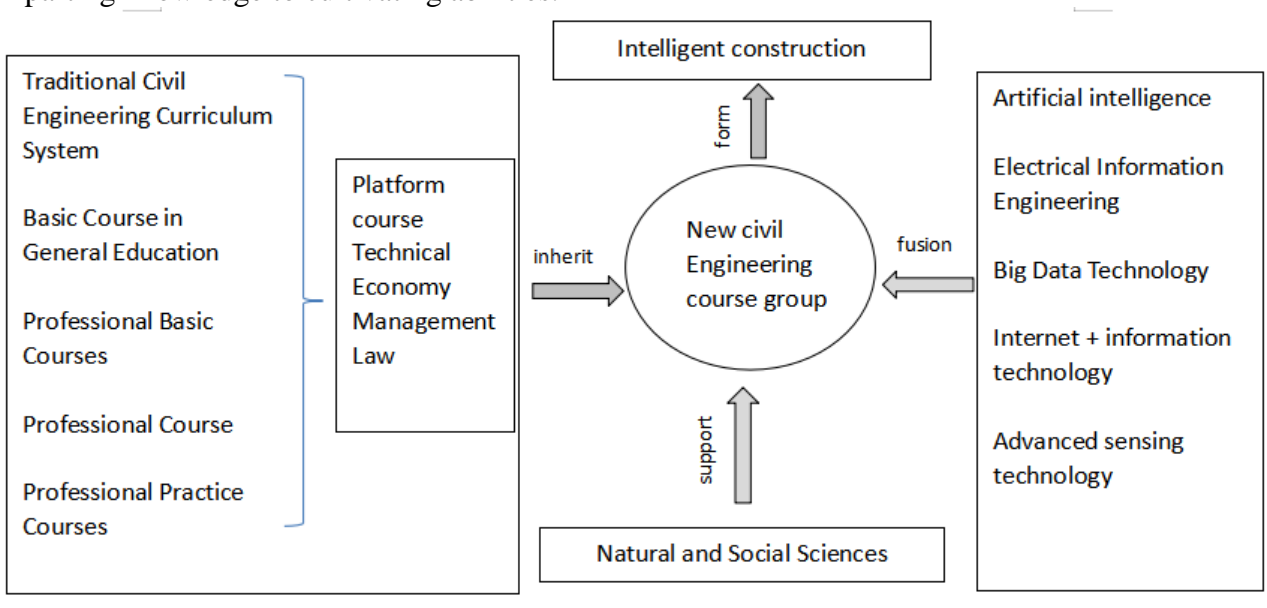


Figure 1: Curriculum Setting of Civil Engineering in the Background of Intelligent Construction

### 3.3. Reform teaching mode

Optimize the organizational model of the school, create new interdisciplinary institutions, establish corresponding quality monitoring systems, and provide corresponding organizational guarantees for the cultivation of new civil engineering talents across disciplines and majors. Based on this, construct a curriculum and practical system for cultivating new civil engineering talents in the form of interdisciplinary integration, show in Figure 2.

### **3.3.1. Build a school enterprise cooperation platform**

Utilize the flexible advantages of the private school system to build a platform for school enterprise cooperation. Actively collaborate with enterprises and research laboratories to establish internship bases, joint laboratories, joint classroom teaching and training centers, joint courses, student innovation projects, entrepreneurship projects, graduation project topics, and enterprise part-time professor investments, creating a joint talent training service platform that closely integrates schools and enterprises. Integrating entrepreneurship education with technology competitions such as the Internet, integrating the application of new technologies, the latest technological achievements in industry, academia, and research, and related information technology into the entire process of talent cultivation, constructing a high-quality talent cultivation service platform, building a professional practical ability training system in a multidisciplinary and integrated environment, emphasizing practical teaching, and improving students' ability to handle complex engineering problems. Based on the combination of practical teaching on campus and off campus internships, classroom teaching knowledge and specific new projects, we have completed a four-year continuous line of practical teaching. Through internships and practical training, cultivate students' comprehensive professional abilities to discover, analyze, research, and solve practical engineering problems using computers, and promote the integration of intelligent emerging technologies and civil engineering education. Through effective course teaching design, the theoretical knowledge of various subjects is connected from experience to practice, from simplicity to complexity, and from module to system, allowing students to "acquire" appropriate "problems" and grow in the process of obtaining problems.

### **3.3.2. Building a collaborative education model**

The talent cultivation of "Intelligent Construction" in Dianchi College of Yunnan University focuses on students' ability to integrate into engineering practice. It adopts two collaborative teaching and education methods: "intra campus collaboration" and "intra class collaboration". It relies on the "intra campus training platform", "off campus practice platform", and the "entrepreneurship incubation platform" of Dianchi College to strengthen students' practical teaching and achieve a continuous line of four-year practical teaching. Break the constraints of the existing administrative, disciplinary, and professional frameworks, and form a multi-disciplinary, multi unit, and multi departmental school enterprise "industry education research" alliance. Integrating multiple advantageous disciplines of the school, leveraging the school's knowledge and talent advantages, actively integrating into the intelligent construction talent cultivation industry chain, becoming a key link in technological innovation in the industry chain, achieving a high degree of integration of intelligent construction talent cultivation, technology services, and innovation and entrepreneurship.

### **3.3.3. Exploring a talent cultivation model that couples theory and practice with a student-centered approach**

Break away from the traditional teaching model of "teacher centered and textbook centered", and explore a "child centered" teaching model that focuses on practical problems in industrial development planning, interdisciplinary and cross-border marketing problems, comprehensive and cutting-edge problems in the future, and combines teacher centered, student independent thinking and learning with work group research and learning. Coordinate the relationship between students' in class and out of class learning, actively encourage students to participate in scientific and technological competitions such as Internet plus and innovation and entrepreneurship practices, and form a talent training model that combines theory and practice.

Fully utilize the three classroom teaching systems, combine production, teaching, research, and application, coordinate the relationship between students' in class and out of class learning, and

cultivate qualified talents in the field of civil engineering intelligent construction.

The first classroom, which is based on the curriculum plan, carries out practical activities mainly focused on curriculum teaching, practice, and science education during classroom teaching, campus experiments, and practical training. Incorporate practical education into the credit system management, and the talent cultivation plan clearly stipulates the duration of internships and practical training courses, with no less than 40% of the actual training hours.

The second classroom, which includes various practical activities such as technological innovation activities, interest groups, university student science and technology cultural and art festivals, academic activities, and club activities, outside of the curriculum plan, on campus. By encouraging students to actively participate in interest group activities, club activities, and subject professional competitions, students' interest in professional learning can be cultivated and their overall literacy can be improved.

The third classroom, that is, going out of the campus, conducting various community practice activities, life practice, labor practice activities, entrepreneurial practice, moral education practice activities, etc. for deep level enterprises and research institutions. Through practical activities in the third classroom, students delve deeper into the research and development of new products and technologies for clean and intelligent vehicles, enabling them to more comprehensively grasp the new trends in professional technology development, further learn new technologies, master new technologies, and apply new technologies.

### 3.3.4. Reform the evaluation method of teaching effectiveness and explore a teaching evaluation system that adapts to new engineering subjects

Teachers need to learn to use new course content and teaching strategies to stimulate students' independent learning ability, teamwork spirit, problem-solving skills, and innovative thinking. They should also change the evaluation methods of teaching effectiveness and explore a comprehensive assessment system for courses from multiple perspectives. Additionally, it is important to introduce a talent training quality system that involves employers and third-party evaluation organizations.

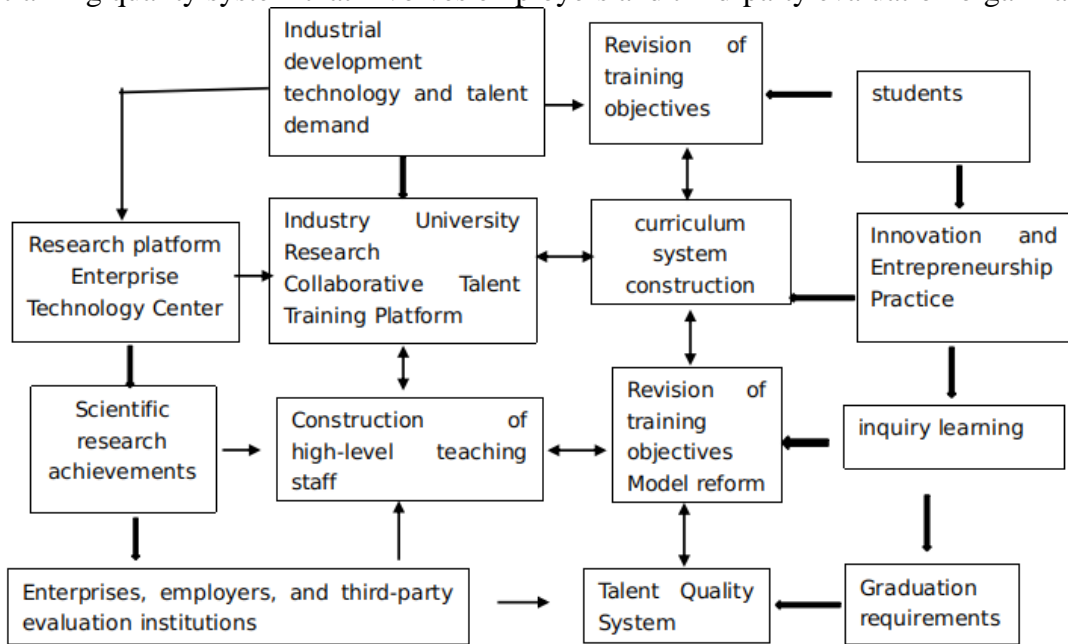


Figure 2: Teaching Reform Ideas and Measures for Civil Engineering under the Background of Intelligent Construction



## 4. Conclusion

Yunnan is located in the western region, which is the core area of the national "the Belt and Road" construction and the macro strategy of the western development. Talent training should be based on Yunnan, oriented to the grassroots, and serve the front line of enterprises. In the context of intelligent construction environment, civil engineering integrates the requirements of intelligent construction technology with the content of previous courses in the field of architecture, and combines with the actual employment situation of most students in the school - construction units. Professional courses are set up to highlight the learning of intelligent construction, intelligent management knowledge, technology, and strengthen practical skills cultivation, in order to cultivate intelligent construction talents who meet the market demand in Yunnan.

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