

# *Compound Talents in Colleges and Universities under the Background of Digital Economy + "Double Carbon": Taking College of Civil Engineering as an Example*

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**Abstract:** High-quality and compound talents are the keys to the rapid development of society, economy and technology. Driven by the digital economy + "dual carbon" goal, the connotation, methods and paths of civil engineering talent cultivation in colleges and universities are constantly changing and upgrading. On the basis of the specific analysis of the connotation characteristics and practical difficulties of cultivating civil engineering compound talents in colleges and universities under the background of digital economy + "double carbon", it has put forward ways and methods to jointly educate teachers' cutting-edge teaching awareness, build a "forward-looking school", establish a cross-college and cross-school credit mutual recognition mechanism, and create new infrastructure. Break through the barriers and practical difficulties of the traditional education mechanism, so as to improve the training quality of civil engineering compound talents in the digital age.

## 1. Introduction

With the rise of China's social economy and science and technology, two major trends of social development have become clear. First, the "dual carbon" target. That is, China will reach the peak of carbon dioxide emissions by 2030, and achieve carbon neutrality by 2060. Which is referred to as the "double carbon" goal, also known as the "30•60" goal. Second, digital economy. With the rapid development of AI technology, cloud computing, Internet of things and big data and other digital technologies, the scale of digital economy has increased year by year. Detailed data as shown in Figure 1, which again shows that the society has already entered the era of digital economy<sup>[1]</sup>. The two major social and economic development trends have set off a wave of great changes in all walks of life. The development of industrial reform cannot be separated from the support of talents. The era of digital economy has put forward new requirements for the cultivation of innovative and compound talents. Therefore, the construction industry with high pollution and high energy consumption has become the first practice field of carbon reduction by digital technology, and digital technology + "double carbon" has become a new element of teaching content. In addition,

great changes have taken place in China's higher education itself. In 2018, Wu Yan, director of the Higher Education Department of the Ministry of Education, proposed that China's "golden curriculum" should have "gender once", that is, high order, innovation and challenge. Among them, innovation means that the course content should reflect the frontier and The Times, the teaching form should be advanced and interactive, and the learning results should be exploratory and personalized. And "double carbon", digital economy is the current society is the most cutting-edge, times, advanced nature of the representative. A good curriculum design is bound to incorporate it.

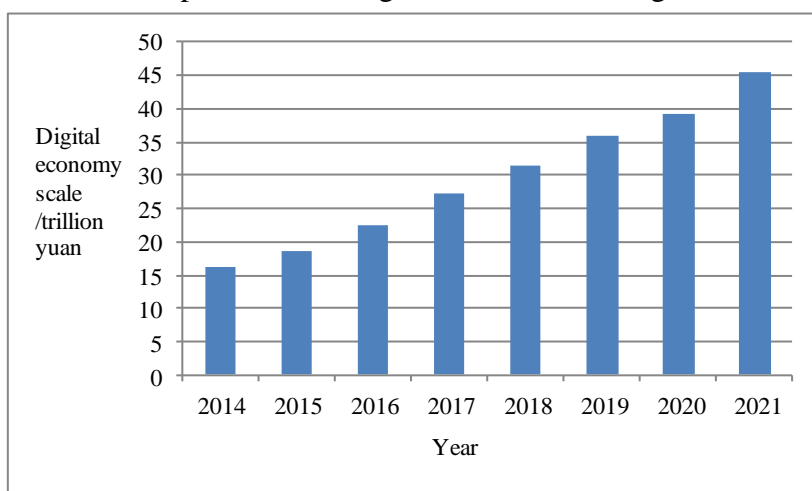


Figure 1: Size of China's digital economy from 2014 to 2021.

## 2. Connotation and Characteristics of Compound Talents in Civil Engineering under the Background of Digital Economy + "Double Carbon"

### 2.1. Interdisciplinary Field of Knowledge and Practice Skills<sup>[2]</sup>

The interdisciplinary nature of digital economy and "double carbon" determines that civil engineering compound talents must have a broad range of knowledge, deep professional foundation and skilled and diverse practical skills. New technologies and methods are closely related to professional basic knowledge, and multifaceted high-level technology integration is inseparable from innovation and professional practice. Students not only master the basic knowledge and practical skills of civil engineering, but also need to be familiar with the basic knowledge and practical application skills of relevant digital technology, green construction technology, smart building and so on. The stronger students' self-learning ability, the broader their basic knowledge and the better their practical skills are, the more they can innovate in interdisciplinary fields and adapt to new technology and new development. On the basis of mastering the professional knowledge and ability, the basic knowledge and skills in the field of digital technology, green construction technology, and smart building are the basic requirements for civil engineering compound talents under the background of digital economy + "double carbon".

### 2.2. Ecological Sustainable Development Thinking and Innovation Ability

Construction industry is recognized as a high energy consumption and high emission industry. Statistics show that China's construction industry emitted 2.17 billion tons of carbon dioxide in 2020. This number runs counter to China's pursuit of ecologically sustainable development. Digital technology is the basis of realizing low-carbon environmental protection, energy saving and emission reduction in the construction industry, the technical support of intelligent building, green

construction and other low-energy and low-pollution buildings, and the booster of building industrialization and re-upgrading. Only when college students have the thinking of ecological sustainable development and innovation ability, can they realize the leap of digital building technology under the background of digital economy, and accelerate the realization and promotion of zero carbon buildings in China.

### **2.3. Lifelong Learning Ability**

Building industrialization development forecast constantly fusion new construction technology in the construction industry, new management model, new material application, this requires that the future construction of interdisciplinary talents must possess the ability of lifelong learning. Only by constantly learning new ideas, new theories and new technologies can we constantly improve ourselves, adapt to the development of the digital age faster and better, and constantly meet the future social demand for compound talents in the construction industry.

### **2.4. Good Communication Skills and Teamwork Spirit**

The continuous expansion of the construction industry chain is the process of in-depth integration and development of different specialties, and is the inevitable result of the continuous upgrading of construction industrialization. The continuous expansion of the industrial chain challenges the communication and cooperation ability of all parties in the industrial chain. Good communication skills and teamwork spirit are the basic requirements for civil engineering students to adapt to future construction positions.

## **3. The Practical Dilemma of Civil Engineering Compound Talents Cultivation under the Background of Digital Economy + "Double Carbon"**

### **3.1. Consciousness Dilemma**

First of all, teachers lack of teaching awareness. According to the questionnaire survey data of science and engineering teachers in Chinese universities, only 21.36% of teachers understand the digital economy and the "dual-carbon" target, and only at the level of scientific research, and have not combined it with teaching. In addition, 67.54% of science and engineering teachers said that social issues often do not integrate with their major courses. It can be seen that the new hot spots and new waves have not been integrated into the teaching process at the first time after their emergence, especially the engineering courses and their combination points still need teachers to make further breakthroughs.

Secondly, the consciousness of the teaching leadership is not high<sup>[3]</sup>. With the development of digital economy in full swing, the goal of "dual carbon" is clearly visible. However, influenced by the traditional thought that majors and science and engineering should focus on students' professional skills, the management of colleges and universities has not realized the essential impact of digital economy and "dual carbon" goal on the training of science and engineering talents, so that the talent training program and curriculum system lag behind the social development.

Thirdly, the diversity of students' consciousness. The diversification of students' consciousness is the product of the diversified development of today's society. First, the long-term and frequent contact between video and social media platforms lays the foundation for the diversity of students' acceptance consciousness. Secondly, the diversity of social job demand forces the diversity of students' career consciousness. The diversity of students' consciousness adds difficulty to the way of integrating hot spots into majors. Some students will turn their noses up at the application of new

technology in their major due to factors such as improper integration, weak operability, high difficulty or poor economic value.

### 3.2. Mechanism Dilemma

Talents training programs of colleges and universities are generally formulated every three years, and a training program can train students for at least one term, with a minimum of three years and a maximum of five years<sup>[4]</sup>. During the implementation of the training program, no changes will be made. It can be seen that the personnel training mechanism of colleges and universities is not flexible, and the social and economic upsurge at the beginning of the development of training programs has long receded after three to five years. In addition, the procurement mechanism of universities is backward. The teaching and application of digital technology cannot be separated from digital equipment, Internet and related software procurement. Government organs and public institutions adopt the government bidding mechanism for bulk goods procurement, which has long time, many processes and slow approval. The procurement mechanism has brought many drawbacks while avoiding risks. Therefore, the procurement mechanism of digital hardware and software adds difficulty to the integration of digital technology into education and teaching.

### 3.3. Practical Dilemma

First, the practice site dilemma<sup>[5]</sup>. The application and popularization of new technology often needs a certain time, especially in the practical application of engineering. The practice application of new technology in promotion generally gives priority to demonstration projects in first-tier cities, which are characterized by small number, large investment and many problems, thus making it more difficult for enterprises to accept a large number of students to operate first-tier sites to observe and learn. Therefore, it is difficult for teachers to combine theoretical teaching with practice. However, the lack of practice further leads to the disconnection between theory and practice.

Second, practical security dilemma. College students are the pillars of the future of the country and the backbone of social development, and the importance of their safety is self-evident. Large-scale off-campus practice has certain security risks. The construction site practice of civil engineering also has many safety hazards<sup>[6]</sup>, such as falling objects, impact and electricity safety, etc., which also bring many adverse factors to practical safety. The number of construction safety accidents and casualties in recent ten years are shown in Figure 2. In addition, the unstable situation of the epidemic at home and abroad makes the problem of safety practice worse.

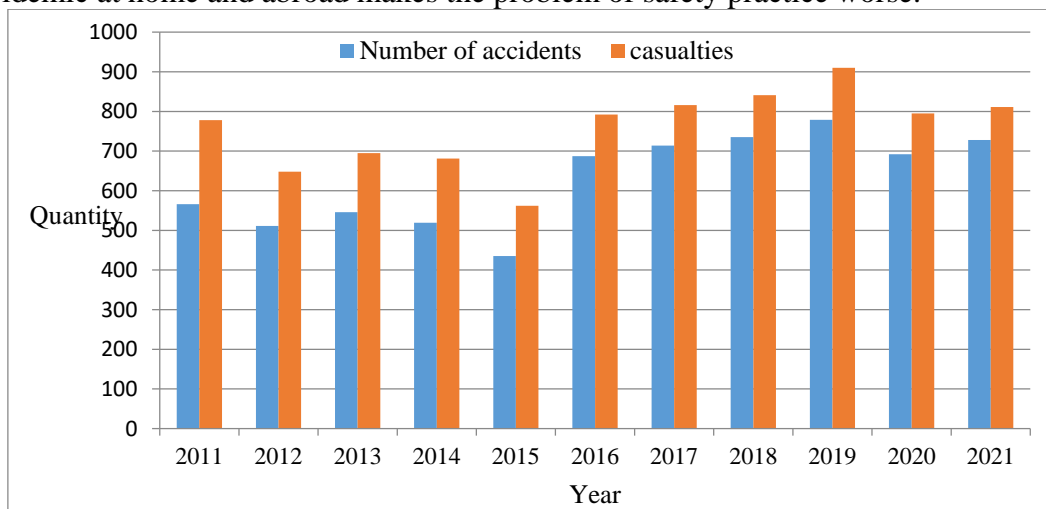


Figure 2: Distribution of construction safety starts and casualties from 2011 to 2021.

## 4. Breakthrough Path of Civil Engineering Compound Talents Cultivation under the Background of Digital Economy + "Double Carbon"

### 4.1. Both Internal and External Education Teachers' Cutting-Edge Teaching Awareness, Improve the Digital Literacy of College Teachers

At the beginning of each semester, the College can offer cutting-edge courses such as digital literacy, green construction, low-carbon building and smart building, combining online and offline courses, and designate continuing education hours for digital literacy. Provide cutting-edge digital training, rely on 5G network and AI technology, build a new system of integrated teacher digital literacy training and training, improve teachers' digital knowledge and ability structure, way of thinking and values<sup>[7]</sup>. Encourage teachers to make full use of online learning platforms, such as NetEase Open Course, China University MOOC platform, Xuetao Online, etc., to improve their digital cultivation and cutting-edge teaching awareness anytime and anywhere. Teachers are encouraged to participate in off-campus seminars on topics such as digital economy, "double carbon" goals and smart buildings. In this way, teachers' awareness of frontier teaching can be achieved and digital literacy can be improved.

### 4.2. Build "Forward-Looking School" to Popularize the Frontier of Society, Economy and Science and Technology

The construction of "forward-looking Academy", that is, a special place in the school or college for the popularization of the front-end application of society, economy and science and technology, combined with the entrance education of new students, cognition practice and other teaching links. The "forward-looking College" constructed by the School of Civil Engineering can focus on the most advanced application of society, economy and science and technology in this major. The content framework is shown in Figure 3. The fundamental purpose of "forward-looking College" is to break through students' understanding of traditional construction mode, construction method and construction technology, break the cognitive barriers of only construction workers, budget clerks and salesmen, popularize the diversity of employment, lead the integration of the diversity of professional positions and the diversity of students' consciousness, and improve the employment rate of majors.

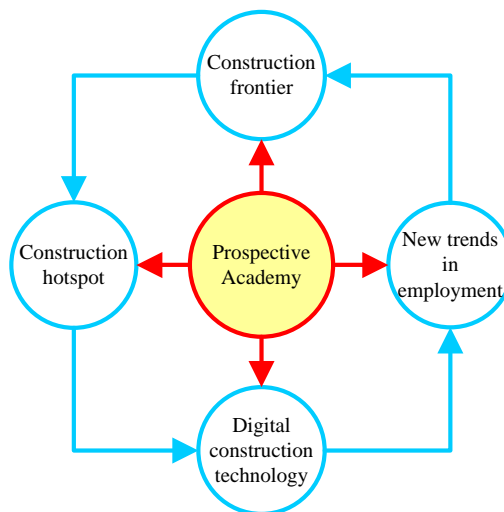


Figure 3: Content framework for the construction of Prospective College of Civil Engineering.

### 4.3. Break the Traditional Barriers to Talent Training and Establish Cross-College and Cross-School Credit Mutual Recognition Mechanism

The establishment of inter-college and inter-school credit mutual recognition mechanism effectively breaks the traditional talent training mechanism<sup>[8]</sup>. First, break through the mechanism of talent training program. The establishment of inter-college and inter-school credit mutual recognition mechanism can effectively ensure that, on the premise of not changing the original training program, students can obtain certain advanced knowledge through minor courses of other colleges, schools and different grades. Second, break through the discipline barrier of traditional talent training. The inter-college and inter-school credit mutual recognition mechanism breaks the problems such as the single knowledge structure and solidified practical ability of talents under the traditional discipline system<sup>[9]</sup>. Credit mutual recognition mechanism is helpful for college students to master interdisciplinary knowledge, cultivate systematic engineering thinking and cross-border integration ability, and improve their ability to deal with practical problems of comprehensive engineering. More can train in line with the digital economic era of social post needs of compound talents.

### 4.4. New Infrastructure Enables Education in the New Era of Digital Economy

The integration of digital economy and "double carbon" goal into education and teaching is inseparable from digital teaching environment and low-carbon campus living environment. The interface of digital economy should focus on building high-end digital infrastructure and creating digital and intelligent teaching environment<sup>[10]</sup>. The fusion points of "two-carbon" goals can be started from the aspects of low-carbon campus, zero-carbon building, building carbon footprint map, etc. At the same time, combining digital virtual simulation technology to provide practical scenes for civil engineering, to break the practical dilemma. Through virtual simulation of the whole process of green building and smart building construction, students can improve their professional practical skills, team communication and collaboration ability, so that students can experience the new learning experience brought by digital technology. Low-carbon concept is combined with digital technology to build new campus infrastructure, enabling education in the new era of digital economy<sup>[11]</sup>.

## 5. Conclusion

High quality and compound talents are the key to the rapid development of society, economy, science and technology. Driven by the goal of digital economy + "double carbon", the connotation, methods and paths of civil engineering talent cultivation in colleges and universities are constantly changing and upgrading. Based on the social background of digital economy + "double carbon" goal, this paper analyzes that civil engineering talents in today's society should have basic knowledge and practical skills in interdisciplinary fields, ecological sustainable development thinking and innovation ability, lifelong learning ability, as well as good communication ability and teamwork spirit. In the face of the current consciousness dilemma, mechanism dilemma and practice dilemma of talent training, it is proposed that both internal and external teachers' pioneering teaching consciousness, improve the digital literacy of college teachers, build "forward-looking academy", popularize the frontier of society, economy and science and technology, and break the traditional barriers of talent training. The establishment of cross-college, cross-school credit mutual recognition mechanism, new infrastructure enabling education in the new era of digital economy four breakthrough paths, in order to cultivate compound talents in line with the requirements of the digital age.

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