

# Research on the Construction of Engineering Management Laboratory under the Background of Intelligent Construction

Liang Mao, Chuxuan Ren\*, Shiqi Teng, Mengting Yuan

School of Management, Sichuan University of Science & Engineering, Zigong, Sichuan, 643000, China

---

## Abstract

With the development of the construction industry, various technologies have been increasingly applied in combination with the construction industry, and engineering management has also shown characteristics of refinement, informatization, and digital management. At the same time, China is in an important window period of traditional construction moving towards industrial and intelligent construction, and at the same time, engineering management professional laboratories have also been promoted and emerged. This article starts with the concept of intelligent construction and comprehensively studies the actual situation of engineering management major. It is found that there are deficiencies in laboratory platform construction, laboratory teaching and teaching staff, and laboratory management in laboratory construction. Suggestions and measures are proposed to improve the construction of experimental platforms, optimize experimental teaching teams, and innovate experimental management systems. Provide certain reference and reference for the construction of engineering management professional laboratories.

## Keywords

Intelligent Construction; Engineering Management; Experimental Teaching; Laboratory Construction.

---

## 1. Introduction

With the continuous development of informationization in the construction industry, China is currently in an important stage of transition from traditional construction to industrialized and intelligent construction. Since the 18th National Congress of the Communist Party of China, the transformation of the development mode of the construction industry has further accelerated. The country emphasizes the need to shift from traditional development models to scientific development paths of green construction, refined management, and information management. In August 2020, the Ministry of Housing and Urban Rural Development issued a document proposing to actively promote the industrialization, digitization, and intelligent upgrading of the construction industry, accelerate the transformation of construction methods, and promote high-quality development of the construction industry. The pioneering development of digitalization, informatization, and intelligence in the construction industry has accelerated the integration of industry supervision and service platforms. At the same time, with the significant improvement of data information utilization and information service level, many problems on construction sites can be effectively solved, and the management and construction capabilities of construction workers on construction sites can also be greatly improved. At the beginning of 2021, the Ministry of Housing and Urban Rural Development of the People's Republic of China clearly stated in a document that the high-quality development of the construction industry should always be the main focus, and the coordinated development of intelligent construction and new industrialization should be accelerated as the driving force to achieve

the transformation and upgrading of the construction industry and the green and low-carbon development of the construction industry. Intelligent construction has overturned the traditional production mode of the construction industry, greatly improving its productivity and promoting its transformation and upgrading.

At present, maintaining high-quality economic development is the long-term development tone of our country, and the phenomenon of cross integration and development between modern industries and multi-disciplinary fields is becoming more and more common. The history of new and old technologies has reached a high level, and the demand for innovative talents for re official positions is becoming increasingly urgent. In this context, it is an inevitable trend for higher education to adapt to social needs and cultivate high-quality, compound and innovative applied talents, It is also an important measure to promote the development of universities based on their own professional characteristics and advantages. In the context of the rapid development of information technology in the modern construction industry, it is crucial to cultivate high-quality innovative engineering and technology talents to meet the talent needs of the construction information age. At present, digital information technology has brought profound changes to the construction industry, and China is making great strides towards becoming a strong country in construction. How to cultivate a group of innovative engineering and technology talents that adapt to the future development needs of the construction industry and respond to industrial transformation and upgrading to meet this development trend has become an urgent issue for higher education talent cultivation. The cultivation of innovative engineering technology talents is closely related to experimental teaching. In order to cultivate innovative engineering technology talents that meet the characteristics of the times, exploring the construction of engineering management professional laboratories under the background of intelligent construction has positive significance.

## 2. Intelligent Construction

At present, as a new construction method, there have been many scholars studying the connotation of intelligent construction, but the connotation and definition have not yet been relatively unified. Regarding the concept of intelligent construction, various experts and scholars have provided different interpretations, and there are also significant differences in the interpretations of this concept among different scholars and experts.

The research on the concept of intelligent construction is gradually accumulating and enriching, indicating that the field is moving towards a more mature and comprehensive direction. This article uses literature research to sort out and analyze the understanding and definition of intelligent construction, defining it as an intelligent building production mode. It refers to not only the extensive use of automated and intelligent mechanical equipment in the building production process to reduce reliance on human production, but also the adoption of new technologies such as digitization, informatization, and artificial intelligence to improve the original building production technology, processes, and management methods, Relying on highly effective data-driven construction throughout the entire process, running through every stage of the construction lifecycle, and maximizing the sharing of building information, we aim to achieve a high degree of collaboration, integration, and informatization throughout the entire industrial chain, in order to improve the level of safe construction, achieve the goal of improving quality, reducing costs, and increasing efficiency, and promote the green and sustainable development of the construction industry.

The future development of intelligent construction will focus on the integration of design and construction, research on the mobility of humanoid robots, improvement of the load capacity and positioning accuracy of intelligent machinery, and the development of construction machinery suitable for intelligent construction scenarios. In addition, the transformation of construction production forms has created new requirements for construction industry practitioners, who should have the ability to respond to changes in the construction industry. The ultimate goal is to achieve affordable intelligent construction production costs, stable work quality, and a people-centered

friendly work environment. Overall, intelligent construction machinery will gradually become the main operating force on construction sites. In the future, there will be a large number of interactions between people and intelligent mechanical equipment on intelligent construction sites. The safety management of human-machine interaction under intelligent construction needs to be paid attention to.

### **3. The Problems Faced in the Construction of Engineering Management Laboratory**

#### **3.1 Insufficient Construction of Laboratory Platforms**

(1)Laboratory instruments are outdated and management funds are insufficient

With the rapid development of the national economy and the continuous increase of Gross Domestic Product, the country's investment in universities is increasing day by day, but the growth of experimental funds in some universities is very slow. In addition, although the investment in some engineering management laboratories has increased, the proportion of per capita experimental resources in the laboratory is declining with the continuous expansion of enrollment. In addition, there is a lack of unified planning for the investment and management of experimental funds in some engineering management projects. For basic experiments, the source of experimental funds is relatively single, and the ability to raise funds through multiple channels is lacking.

(2)Low efficiency of experimental equipment usage

In recent years, with the transformation of the engineering management profession, we are committed to actively promoting professional adjustment and transformation. However, the experimental equipment is relatively lagging behind. Similar majors purchase the same experimental equipment, which limits the investment of engineering management funds in the repeated procurement of equipment, resulting in low utilization rates of experimental equipment and a certain waste of funds. Due to the poor openness of engineering management laboratories, a large number of experimental equipment has been idle in their spare time and cannot fully utilize their value.

#### **3.2 Insufficient Laboratory Teaching and Teaching Staff**

(1)Lack of high-level experimental teaching and management personnel

Experimental teaching and management personnel are the fundamental members of the laboratory, responsible for the construction of the laboratory's teaching and research platform, maintenance of instruments and equipment, system updates, and open management. The management of experimental equipment is the fundamental work to ensure the effectiveness of experimental teaching and the achievements of experimental innovation. However, at present, the engineering management profession does not attach enough importance to laboratory work, and there is a lack of recruitment for full-time teachers in experimental teaching and management. In addition, laboratory management personnel also struggle to receive the same level of salary and treatment as theoretical teaching teachers, which reduces the enthusiasm of laboratory personnel and leads to frequent personnel turnover. These phenomena are not conducive to the development of experimental teaching and equipment maintenance, but also hinder the independent research and development activities of the laboratory.

(2)The overall level of the experimental personnel team is relatively low

There is still a certain gap in salary and welfare benefits between full-time laboratory teachers in engineering management, which directly leads to the difficulty of retaining outstanding talents in the laboratory and the reluctance of graduates to apply for laboratory positions. Therefore, the overall educational level of experimental technicians is usually not high, and the proportion of highly educated and professional personnel in the laboratory is relatively small, and the application technology and innovation ability of experimental personnel are relatively weak. The experimental technology team not only has a small number of personnel, but also has varying qualities of experimental personnel. Some laboratory staff with lower educational backgrounds lack professional

basic knowledge and research experience, making it difficult to update the teaching content and improve the teaching level in experimental teaching. Laboratories are often independent of the teaching and research department, and excessive segmentation can lead to communication and assistance between different laboratory staff. There is also a lack of communication between laboratory personnel and the theoretical course teaching team, resulting in a lack of opportunities for theoretical research and teaching. For a long time, most experimental personnel lack innovation awareness and enthusiasm.

### **3.3 Insufficient Laboratory Management**

#### **(1) Lack of reasonable application and management of experimental funds**

Laboratory funding is the fundamental guarantee for conducting teaching and research work. The reasonable application and management of laboratory funding is an important guarantee for improving teaching quality, and is also one of the basic conditions for conducting scientific research and technological innovation activities. According to the usage of funds, it can be divided into experimental equipment procurement costs, special research funds, and experimental consumables costs. If the management of experimental funds is not strict, the experimental funds that are prone to cost shortages may be potentially misappropriated and wasted.

#### **(2) Unreasonable laboratory management system**

At present, the laboratory management system still adopts a three-level management model (school level, college level, and department level). This management model is mainly divided based on different majors, and many interdisciplinary laboratories have the phenomenon of duplicate construction, resulting in the waste of already limited laboratory funds in duplicate construction. The management system of the engineering management laboratory is not reasonable enough, and the management system is relatively incomplete. There is still a significant gap between it and the goal of achieving standardized and standardized management.

#### **(3) Insufficient openness and communication in the laboratory**

The openness of the engineering management laboratory is poor, and the degree of openness is still not high in the intelligent construction environment. The proportion of experimental parts in the teaching plan is low, the experimental hours are limited, and there is a lack of innovative design experimental content. In this situation, it is difficult to effectively enhance students' innovation ability. And most of the experimental content is too outdated, neglecting the cultivation of personalized thinking for different students. Some experimental courses in engineering management are mainly based on a closed teaching management model, which is not open to teachers and students in other majors. Moreover, students in this major find it difficult to have the opportunity to apply for laboratory study outside of the experimental classroom.

## **4. Suggestions for the Construction of Engineering Management Laboratory under the Background of Intelligent Construction**

### **4.1 Improve the Construction of Experimental Platforms**

#### **(1) Improve laboratory functions**

In the context of intelligent construction, engineering management laboratories should not only meet the daily teaching and research activities of a large number of teachers and students, but also actively tap into their own potential, innovate research and training activities, develop and improve the functions of instruments and equipment, actively carry out industry university research cooperation, provide intelligent construction related services to the government and enterprises, and charge reasonable fees during the service process. This approach not only enhances the innovation ability of the laboratory, but also integrates the latest scientific research and innovation achievements into the daily teaching of the laboratory, thereby improving the quality of student training; It also helps to apply the innovative achievements obtained in the laboratory to practice, not only solving the

economic difficulties in the development and management of the laboratory, but also bringing considerable economic and social benefits to society and enterprises.

#### (2) Improve the management system of experimental equipment

To fully utilize existing equipment, it is necessary to improve and innovate the existing rules and regulations of the engineering management professional laboratory. A management account for instruments and equipment can be established based on the funding source, application direction, equipment maintenance and usage situation at the time of purchase, facilitating unified management. In addition, based on the management situation of the laboratory, the basic information of the full-time personnel, experimental requirements, project categories, and other basic information of the laboratory established can be classified and summarized to ensure a more organized and clear management of the laboratory. Efforts should be made to build an information network platform for laboratory resource management, which integrates various instruments, equipment, rules and regulations in the laboratory. The list of relevant experimental guidance personnel is published on the network platform of the experimental center, facilitating teachers and students to timely understand the operating status of laboratory instruments and equipment, such as whether the equipment is being operated, repaired, or maintained.

### 4.2 Optimize the Experimental Teaching Team

#### (1) Improve the salary and welfare benefits of experimental personnel, and improve the promotion mechanism for professional titles.

There is a significant gap between full-time experimental teachers and theoretical teaching teachers in terms of salary, benefits, and promotion opportunities. Therefore, the work enthusiasm of experimental teaching and management personnel is often not high. The engineering management major should improve the treatment of experimental personnel in various aspects to a certain extent. In addition, the evaluation of professional titles should take into account the particularity of experimental teaching, and include teaching workload, work attitude, problem-solving ability, scientific research innovation ability, etc. into the evaluation system, reflecting fairness as much as possible to enhance the identification of laboratory personnel. At the same time, experimental teaching and scientific research innovation should be included in the year-end teacher assessment and professional title evaluation system, and laboratory personnel should be encouraged to carry out more experimental teaching and scientific research innovation. In addition, laboratory personnel can be regularly evaluated and prioritized through the establishment of the Excellent Experimental Teacher Award, Experimental Innovation Award, and Excellent Experimental Team Award, fully mobilizing their work enthusiasm.

#### (2) Encourage the construction of high-level experimental management and maintenance teams.

Compared to the experimental teaching team, the experimental management and maintenance team is also an important component of the laboratory's basic research team. It is mainly responsible for the construction of a laboratory teaching and research platform, as well as the operation, maintenance, and upkeep of instruments and equipment.

#### (3) Improving the comprehensive quality of the experimental personnel team

Encourage experimental personnel to have self-learning abilities. In today's rapidly updated knowledge, relevant management departments in universities should pay attention to the continuous improvement of the professional skills of laboratory personnel. The engineering management major organizes professional skills competitions related to intelligent construction for experimental personnel to encourage experimental teachers to continuously learn and improve their professional skills. Actively encourage experimental personnel to learn and train in relevant enterprises. We can organize experimental guidance teachers to participate in industry specific training activities in relevant enterprises in a planned manner, and strongly support relevant experimental personnel to participate in various registered vocational qualification exams organized by the state, and provide certain rewards to those who obtain certificates.

### 4.3 Innovative Experimental Management System

#### (1) Innovative experimental management system

The job responsibility management system for laboratory staff: This system should clarify the job responsibilities of laboratory management personnel at all levels and experimental teaching personnel, and make clear provisions for the work obligations and rights of each position personnel, in order to facilitate staff to act in accordance with relevant regulations. Laboratory assessment system: Establish and improve the assessment system of the laboratory, and regularly evaluate the teaching effectiveness and scientific research innovation work of the laboratory. Laboratory inspection and guidance system: Strengthen the inspection and supervision of the hospital leadership on the laboratory, and regularly arrange inspectors from relevant departments to supervise the laboratory. Open laboratory management system: Implementing open laboratory management can help break the traditional closed management model and facilitate teachers and students to participate in scientific research and practical activities in their spare time.

#### (2) Implementation of innovative experimental management system

Adopting a hierarchical management model. With the increasingly close infiltration and intersection of various disciplines, the drawbacks of decentralized laboratory management are becoming increasingly prominent. One of the important contents of laboratory structure reform is to optimize the management mode. The first level management model of the laboratory is to revoke the influence of the department's teaching and research department on the management of the laboratory, and to have a specially established experimental teaching management center directly manage the laboratory and experimental teaching courses. This approach avoids problems such as difficult monitoring of teaching and duplicate laboratory construction, improves the efficiency of the laboratory, and facilitates the implementation of various management systems.

#### (3) Innovative laboratory funding management system

Actively carry out the construction of laboratory fund management system and gradually improve the level of laboratory fund management. Strengthen the planning efforts for the use of laboratory funds. The laboratory should centrally manage funds, develop a reasonable plan for the use of funds, and conduct a reasonable evaluation of the benefits of fund investment in order to create the greatest possible value for the invested funds.

## 5. Conclusion

In order to meet the needs of economic and social development and the construction of an innovative country, the concept of talent cultivation has gradually transitioned from emphasizing theory over practice to emphasizing hands-on, practical, and innovative abilities. Strengthening the construction of laboratories and internal and external internship bases is an important condition for improving the quality of higher education and completing the cultivation of innovative talents. This article starts with the concept of intelligent construction and comprehensively studies the actual situation of engineering management major. It is found that there are deficiencies in laboratory platform construction, laboratory teaching and teaching staff, and laboratory management in laboratory construction. Suggestions and measures are proposed to improve the construction of experimental platforms, optimize experimental teaching teams, and innovate experimental management systems.

## Acknowledgments

The research reported in this paper was supported by teaching reform project of Sichuan University of Science & Engineering under Grant Comprehensive Reform of Engineering Management under the Background of Intelligent Construction(JG-2210) and Research on the Optimization Path of Practical Teaching in Engineering Management(JG-2343).

## References

- [1] Wang Chan. Application of Intelligent Construction in Civil Engineering Construction [J]. Juye, 2023 (08): 74-76.
- [2] Zhao Xingxiang, Zhu Meichun. Exploration of Intelligent Construction Talent Training Mode Based on Core Literacy [J]. Higher Architecture Education, 2023,32 (04): 64-69.
- [3] Limwickitr, S., Broady Preston, J. and Elis, D. A discussion of problems in implementing organizational cultural change: developing a learning organization in University Libraries [J], Library Review. 2015, (4): 480-488.
- [4] Cao Yanqing, Zhang Saiwen, Wan Zhuo Exploration on the Construction and Management of Electronic Innovation Training Laboratory under the Collaborative Education Model between Schools and Enterprises [C], Proceedings of the Guangdong Teachers' Continuing Education Association and the Guangdong Teachers' Continuing Education Association Teacher Development Forum Academic Seminar (III) 2023:61-63.
- [5] Shi G. Construction and Management of Innovation and Entrepreneurship Laboratories in Colleges and Universities [J] Engineering Advances, 2023,2 (2).
- [6] Yu Cong, Research on the Problems and Countermeasures of Laboratory Management in Universities [D], Tianjin University, 2012.