

# Research on Innovative Teaching Model for Hydraulic Building Courses in Local Colleges and Universities

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**Abstract:** In an innovation-driven era, reforming university innovation and entrepreneurship education is crucial. Analyzing the "Hydraulic Buildings" course and its teaching reforms, combined with foreign innovative talent training models, this paper explores a training program for water conservancy innovative talents. Through literature review and case analysis, we assess domestic and foreign teaching reform achievements and propose further reforms. By enhancing teaching reform, integrating innovation and entrepreneurship education, and fostering industry-university-research cooperation, we aim to improve students' comprehensive quality and innovation ability, supporting the national innovation-driven strategy with water conservancy talents.

**Keywords:** Innovation and Entrepreneurship; Education Reform; Industry-university-research Model; Practical Education.

## 1. Introduction

Under the background of "mass entrepreneurship and innovation", innovation and entrepreneurship education are new educational concepts that arise along with the national economic development. Deepening the reform of innovation and entrepreneurship education in institutions of higher learning is an urgent need for the country to implement the innovation-driven development strategy. At the same time, in order to support the rapid development of the new economy and cultivate new engineering innovative talents, the new engineering education concept emerged at the historic moment, and in 2017, the new engineering plan [1] was officially launched. The course of "hydraulic structures" is a compulsory professional course of water conservancy and hydropower engineering, which plays an important role in the training of water conservancy talents. Domestic universities have reformed the teaching mode of "hydraulic structures" and achieved some results [2-3], but how to integrate innovative education and cultivate innovative talents of water conservancy is relatively lacking.

On the basis of summarizing and analyzing the teaching status and teaching reform achievements of this course, this paper draws on the training mode of innovative and entrepreneurial talents in foreign universities. Combined with the characteristics of "hydraulic structures" course [4], to solve the problem of lack of innovative consciousness and ability of talents trained under the traditional education system, aims to actively explore the training program of talents for innovative talents in water conservancy, and promote the improvement of the comprehensive quality and innovation ability of students majoring in water conservancy.

## 2. Analysis of Research Status at Home and Abroad

### 2.1. Teaching Reform Achievements of Hydraulic Buildings in Domestic Universities

(1) Adjust the teaching content of hydraulic structures. According to the local economic characteristics and

geographical environment, local universities in China conduct selective teaching of teaching materials. The teaching contents of all kinds of hydraulic structures and structures are summarized as: overall layout, structure calculation, stable calculation, form and structure, etc. In classroom teaching, the knowledge points, such as stable calculation methods are similar, can be explained in the chapter of "gravity dam".

(2) Diversified teaching methods.

The traditional cramming teaching method reduces the students' enthusiasm and initiative in learning. Some colleges and universities continue to reform their teaching methods and actively introduce modern teaching methods: 1) Combine multimedia means. Use pictures, videos and other tools to abstract into concrete, give students perceptual cognition; 2) improve the computing software application ability. The simulation model intuitively shows the stress process and deformation process of the structure under the load, so that students have a clearer understanding of the structure; 3) Add construction drawings. Promote engineering cases, field drawings and theoretical knowledge to complement each other to cultivate students' post adaptability.

(3) Pay attention to practical teaching.

In course teaching, field practice and model research; strengthen the course design, as a practical teaching link of hydraulic structures, course design plays a vital role for students to master course knowledge and flexible application, formulate detailed course design plan to strengthen students' comprehensive application ability of professional knowledge.

(4) Improve the curriculum assessment and evaluation system.

Students' comprehensive ability is assessed according to the results of the basic ability test and practical ability test. The basic ability includes classroom performance, after-school homework, examination results, etc., while the practical ability includes course design, comprehensive practice, experimental operation, etc. Establish and improve the course assessment and evaluation system, assess the students' comprehensive ability, and fully reflect the students' comprehensive quality.

## **2.2. Teaching Reform Achievements of Hydraulic Buildings in Foreign Universities**

(1) The concept of innovation and entrepreneurship education leads the construction of innovative talent training mechanism.

The idea of innovation and entrepreneurship education comes from the United States. So far, it has developed into a mature and effective talent training mechanism, which is known as the "direct driving force" of the development of the United States. The reason why Harvard University stands out as the "king of Kings" among many universities in the world lies in its continuous and effective concept of innovation and entrepreneurship education and the talent training mechanism that integrates innovative education. Colleges and universities are not limited to academic guidance, but take innovative ideas as the orientation of running schools, and shoulder the responsibility of social innovation and development.

(2) Build a stable model of industry-university-research cooperation to cultivate innovative talents.

"To build a technological innovation system with enterprises as the main body, the market as the guidance, and the combination of industry-university and research institutes" is an important measure for the country to implement the innovation-driven development strategy. Japan, the United States and other countries have developed their own characteristics in the talent training mode of industry-university and research institutes. For example, in the United States, the industry-university-research innovative talent training mode mainly shows the "cooperative training", which is formed through government policy support, cooperative training between enterprises and schools, and cooperative research between universities. In the teaching process, theoretical knowledge should be integrated into practice so that the practical process can be supported by scientific theories, forming a mature industry-university-research cooperation training mode of "enterprise-oriented as the main body and market-oriented".

(3) Active campus innovation culture to promote the training of innovative talents.

Create a campus innovation culture and inject new vitality into the cultivation of innovative talents. As a kind of subculture, campus culture is the precipitation of the long-term history of universities and the symbol of the traditional spirit of universities. Campus culture has a subtle influence on students. A positive learning atmosphere and a strong innovative atmosphere can stimulate students' spirit of independent learning. Just as the school motto of Harvard University, "Snap now, you will dream; study now, you will realize your dream" and so on. With rigorous academic research atmosphere, innovative and competitive consciousness, and positive attitude towards life, we have cultivated generation after generation of excellent students. The intangible campus culture urges students to be proactive and study independently, and inject new vitality into the cultivation of innovative and entrepreneurial talents from the spiritual level.

## **3. Specific Implementation Plan**

### **3.1. Adopt a New Mode of Talent Training based on Inquiry Learning**

(1) Open seminars.

The school actively offers seminar courses, organized by professional teachers, in a group of every 8-10 students. Based on the knowledge points of the professional courses, the teacher guides the students to find the problems and put forward the research objectives. On the basis of no answers, students analyze the problems by themselves. Through literature searching, case analysis, field practice, model simulation and other forms, the team members constantly communicate and improve the topic, and finally solve the problems through reports and papers.

(2) Introduction of "thematic self-study" in classroom teaching.

Classroom teaching should be changed from knowledge classroom to ability classroom. For some topics, students should study by themselves in groups, including the understanding of knowledge points, the analysis of technology, and the application of engineering cases, etc. Later, the self-study results will be displayed in class in the form of PPT speech, and the teacher will score the learning results and count them into the usual results.

### **3.2. Increase Knowledge in Teaching Content and Stay Updated with Professional Trends**

The course of "Hydraulic Buildings" has high requirements for engineering practice, and is closely combined with engineering examples in the process of learning. In the teaching process of the course, should not be limited to the interpretation of basic teaching materials, but at the same time, combined with the tutor own research, analyze the latest industry trends and the practical application of knowledge content, teach new materials, new technology, new technology, new ideas, such as professional trendy, classroom into the latest construction technology, typical engineering cases, basic project management and design concept, increase students' frontier knowledge, expand knowledge reserves, stimulate students' interest in professional learning and innovative thinking. Such as waxy plunge into crossing high earth dam, la xiwa, small wan, jin screen, xiluodu, crane beach high arch dam construction simulation, as well as the dam design innovation concept and construction of technical problems and innovation breakthrough, and the dam of the dam, found in the operation management of research and engineering and non-engineering measures into the course teaching. In addition, for hydraulic structures with regional characteristics, such as sluice and sluice station combined with innovative design, construction and reinforcement measures, as well as new methods of energy dissipation, seepage calculation and stability analysis, typical engineering cases can also be explained and discussed in teaching.

### **3.3. Build a "Collaborative Innovation" Talent Training Model**

Under the background of scientific and technological innovation, it is imperative to promote the "collaborative" innovation training mode such as school-enterprise cooperation, government policy support and university-university cooperation. Colleges and universities should respond to the call of international innovation and entrepreneurship education and actively follow the trend of building the talent training mode of industry-university-research cooperation.

(1) School-enterprise cooperation, the establishment of talent training base.

The school cooperates with local enterprises to bring professional project leaders and senior technical personnel into the expert team, and form a guidance team with professional teachers in the school. The scientific research ability of the enterprise is weak, so it can solve the engineering technical difficulties and doubts by relying on the talent training base. Meanwhile, the university uses the scientific research platform provided by the enterprise to cultivate students' scientific research level and innovation ability.

(2) Attach importance to the supporting role of government policies and promote talent training.

In the training mode of industry-university-research cooperation, the government has the role of management, organization, coordination and promotion, and can promote the cooperation and research of industry-university-research cooperation by formulating perfect, supporting and reasonable policies and measures. The government's policy support can better promote the enthusiasm of multi-party cooperation between industry, university and research institute, realize the professional and industry complement each other, and provide high-quality innovative talents for the society.

### **3.4. Strengthen the Training of Practical Ability**

Innovative talents require innovative thinking and innovative ability. Innovative thinking aims to put forward new ideas, new theories and new methods to solve problems through a unique perspective and thinking mode. Innovative ability requires exploring new fields on the basis of the original knowledge, absorbing and integrating knowledge points and innovating, so as to make the original problems more novel. The key to the cultivation of innovative talents lies in the cultivation of practical ability. Based on the course training program of "Hydraulic Engineering", strengthen the cultivation of innovative ability and enhance students' understanding and application of professional courses.

(1) Add innovation practice credits.

To exercise students' understanding and use of professional knowledge, professional training system add innovation credits, requires students during the school independent at least one innovation project, such as the design of the sluice, building structure innovation, project technology innovation, research of new materials, etc., in the form of paper, patent as a project concluding results.

(2) Combine theory with practice.

From closed classroom teaching to open classroom, from the traditional teacher, classroom, teaching materials, to the time from classroom to extracurricular, space from classroom to laboratory, engineering site, library, the content from teaching materials to references. For example, I learn the topic of "water stop", learn the type, function and working principle of water stop in class, consult relevant literature in spare time, and use the model to simulate the process of "water stop", so as to make knowledge learning more solid.

(3) Improve the weight of professional experimental courses.

Innovative education emphasizes the significance of water conservancy professional experiments in cultivating innovative talents. These experiments foster talent development by breaking traditional teaching methods, encouraging students to explore principles and obtain results independently. To enhance the curriculum, it should

encompass demonstration, verification, design, and comprehensive experiments, bolstering students' knowledge retention, engagement, and practical skills.

(4) Actively hold and participate in water conservancy innovative design competitions.

The cultivation of the school's innovation culture is conducive to creating a positive learning atmosphere. Actively holding and participating in water conservancy innovation competitions can not only cultivate students' competitive consciousness of innovation and struggle, but also enable them to learn professional skills in the competition.

## **4. Expected Results**

### **4.1. Expected Results of the Study**

Under the new mode of talent training based on inquiry learning, by increasing the teaching content of cutting-edge knowledge and following the professional trend, the school-enterprise "collaborative innovation" talent training mode is constructed to enhance the cultivation of students' practical ability.

### **4.2. Scope of Implementation and Benefit from Teaching**

- (1) A new mode of talent training based on inquiry learning;
- (2) The teaching content increases the cutting-edge knowledge and keeps up with the professional trend;
- (3) Build the school-enterprise "collaborative innovation" talent training mode;
- (4) Enhance students' cultivation of practical ability.

### **4.3. Expected Major Innovations**

"Hydraulic engineering structure" is one of the core professional courses of water conservancy and hydropower engineering. With the background of examination and evaluation, this paper highlights the cultivation goal of students' innovation ability, analyzes the current existing problems in the teaching of this course, and combines with the teaching practice, and explores the teaching reform from four aspects of talent training, teaching content, school-enterprise cooperation and students' practice. Research results have positive impacts on enhancing students' learning initiative and fostering their analytical and problem-solving skills in engineering.

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