https://doi.org/10.62836/jissh.v2i2.470

Global Science Publishing

JISSH

Journal of Integrated Social Sciences and Humanities

https://ojs.sgsci.org/journals/jissh

Article

Research on Innovation of Talent Training Models in Mechanical Engineering under Sino-Foreign Cooperative Education

Xiaoyan Wu [1,*] and Shu Wang [2]

[1] *Hubei Key Laboratory of Intelligent Convey Technology and Device, Hubei Polytechnic University, Huangshi 435003, China*

[2] *School of Mechanical and Electrical Engineering, Hubei Polytechnic University, Huangshi 435003, China*

Abstract: Sino-foreign cooperative education in local applied universities serves as a crucial pathway for cultivating international engineering and technical talent. This study focuses on the Mechanical Design, Manufacturing, and Automation (Sino-foreign Cooperative Education) program within the School of Mechanical & Electrical Engineering at Hubei Polytechnic University. Aligning with the university's "applied, local, and open" orientation and the industrial characteristics of the Huangshi region, the paper analyzes existing issues in talent training objectives, curriculum systems, practical teaching, and faculty development. It proposes a reform pathway centered on a "Tripartite Integration" talent training model: "Integration of International Standards and Local Needs", "Integration of Theoretical Teaching and Engineering Practice", and "Integration of Sino-Foreign Resources and University-Industry Collaboration". Through measures such as optimizing training objectives, restructuring the curriculum system, innovating teaching models, and strengthening faculty development, the study provides practical references for enhancing the quality of mechanical engineering programs under Sino-foreign cooperative education in local applied universities.

Keywords: local universities; applied; Sino-foreign cooperative education; Mechanical Design, Manufacturing, and Automation; talent training model

1. Introduction

1.1. Research Background

Under the national strategy of "China Manufacturing 2025" and the backdrop of industrial transformation and upgrading, the mechanical manufacturing industry faces an increasingly urgent demand for interdisciplinary talent possessing both "international vision" and "engineering practice capabilities" [1]. As key institutions serving regional economies, mechanical engineering programs within Sino-foreign cooperative education frameworks at local applied universities bear significant responsibility for cultivating such talent [2]. Hubei Polytechnic University, a provincial applied undergraduate institution in Hubei Province, launched a cooperative program in Mechanical Design, Manufacturing, and Automation with Herzing University (USA) in 2015. The initiative aimed to enhance the quality of talent cultivation by introducing international educational

Received: 1 July 2025; Accepted: 16 July 2025.

* Corresponding: Xiaoyan Wu (201091@hbpu.edu.cn)

resources [3]. However, as the program matured, issues such as the "disconnect between internationalization and localization" and the "imbalance between theory and practice" became apparent, necessitating model reform to overcome developmental bottlenecks [4].

1.2. Research Significance

The reform practices within this program at Hubei Polytechnic University are emblematic. On one hand, the university is located in Huangshi City—a major industrial hub in the middle reaches of the Yangtze River. The robust demand for mechanical engineering talent from clusters such as equipment manufacturing and new materials provides a natural foundation for aligning the program with local industry. On the other hand, challenges like cultural differences and conflicting educational philosophies inherent in the Sino-US cooperative model are common across similar programs at local universities. Therefore, research using this program as a case study offers solutions for its own development while providing valuable insights for reforming analogous programs at peer institutions.

2. Current Status and Challenges in Talent Training under Sino-Foreign Cooperative Education

2.1. Program Overview

The Mechanical Design, Manufacturing, and Automation (Sino-foreign Cooperative Education) program at Hubei Polytechnic University follows a "3 + 1" model: students study domestically for the first three years and may transfer to Herzing University (USA) for their fourth year, graduating with dual degrees. Core courses include Mechanical Design, Fundamentals of Manufacturing Technology, and Fundamentals of Control Engineering, with 30% taught by US faculty using English textbooks. By 2024, the program had produced over 600 graduates, maintaining an employment rate of approximately 90%. However, fewer than 15% secured positions in high-end equipment manufacturing or multinational corporations, indicating a gap between outcomes and program objectives [5].

2.2. Key Existing Challenges

(1) Vague Training Objectives with Insufficient Local Industry Alignment: Initial program objectives directly replicated Herzing University's "general mechanical engineer" standards, emphasizing "international perspective" and "theoretical depth" without adequately integrating Hubei Polytechnic's "applied" orientation or Huangshi's industrial profile. For instance, Huangshi, a significant national hub for intelligent equipment manufacturing (e.g., Dongbei Group, Daye Special Steel), urgently needs talent proficient in smart manufacturing and precision machining. Yet, relevant content constitutes less than 10% of the curriculum, resulting in low local employment rates (35%) and graduate feedback citing poor retention and industry readiness ("retain poorly, apply poorly").

(2) Fragmented Curriculum with Disjointed Practical Training: Curriculum Misalignment: US courses (e. g., Advanced Manufacturing) focus on theoretical models and Euro-American industry cases, while Chinese courses (e.g., Fundamentals of Mechanical Manufacturing) emphasize traditional processes. This lack of integration leads to student feedback such as "learned American technology, but cannot operate domestic equipment."

(3) Insufficient Practical Emphasis: Practical courses account for only 25% of total credits, primarily consisting of on-campus labs (e.g., metalworking internships) with minimal real-world enterprise training. The cooperative "International Training Project" with Herzing University attracts fewer than 20 students annually due to funding constraints and language barriers.

3. Reform Ideas and Innovative Measures for Talent Cultivation Model

3.1. Constructing a "Three-Dimensional Integration" Cultivation Objective System

Combining Hubei Polytechnic University's "application-oriented" orientation and Huangshi's industrial needs, the cultivation objectives of "international standards + local practice + innovative literacy" are established:

(1) International Dimension: Master the international general standards in the field of mechanical engineering (such as ISO9001, ASME specifications), have English cross-cultural communication skills, and be

able to participate in international engineering projects [6].

(2) Local Dimension: Deeply engage in the intelligent equipment and new material industries in Huangshi and southeastern Hubei, cultivate application-oriented talents who are "capable of operation, improvement, and management". For example, add targeted modules such as "Dongbei Refrigeration Equipment Maintenance" and "Daye Special Steel Precision Machining" [7].

(3) Innovation Dimension: Through "disciplinary competitions + enterprise projects", cultivate students' innovative thinking in the fields of intelligent production line optimization and green manufacturing. In the past two years, students of this major have won 8 provincial awards in the "National College Students' Mechanical Innovation Design Competition", reflecting the initial effect of innovation cultivation [8].

3.2. Reconstructing a "Modular and Integrated" Curriculum System

3.2.1. Curriculum Module Design

Based on the concept of "Sino-US integration and integration of posts, courses, competitions and certificates", four modules are set up [9]:

General and International Literacy Module (20 credits): Including American courses "Academic Writing", "Cross-Cultural Communication" and Chinese courses "An Introduction to Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era", "Fundamentals of Innovation and Entrepreneurship".

Professional Foundation Module (40 credits): Integrate the American course "Engineering Mechanics" with the Chinese courses "Theoretical Mechanics" and "Material Mechanics", and compile the bilingual lecture notes "Engineering Mechanics: Comparison and Application of Sino-US Exercises".

Characteristic Direction Module (30 credits): Divided into two directions of "Intelligent Equipment" and "Precision Manufacturing", introducing technical standards of Huangshi enterprises. For example, co-building the course "Refrigeration Machinery Design" with Dongbei Group.

Practice and Innovation Module (30 credits): Including "Sino-US Joint Training" (such as virtual simulation of American factories, rotating internships in Huangshi enterprises) and "School-Enterprise Joint Projects" (such as automation transformation of production lines).

3.2.2. Case of Curriculum Content Integration

Taking the core course "Mechanical Manufacturing Technology" as an example, before the reform, American textbooks (focusing on European and American automobile manufacturing cases) were used. After the reform, a "3 + 3 + 4" content system is constructed: 30% international advanced technology (such as German Industry 4.0 production lines), 30% domestic industry standards (such as GB/T mechanical processing specifications), 40% Huangshi enterprise cases (such as special steel processing technology of Daye Special Steel). A virtual simulation experiment platform is developed to realize "online international benchmarking + offline local practice" [10].

3.3. Innovating the "School-Enterprise Collaboration, Sino-US Linkage" Teaching Model

3.3.1. "Dual Tutors + Project-Based" Teaching

Each professional course is equipped with an "American academic tutor + Chinese enterprise tutor": American tutors are responsible for teaching international cutting-edge theories (through a combination of online and offline methods), and Chinese enterprise tutors (such as engineers from Dongbei Group) lead students to complete real enterprise projects. For example, in the 2023 "intelligent packaging machinery improvement" project, under the guidance of Chinese and American tutors, the student team designed an automatic feeding device for an enterprise in Huangshi, which increased production efficiency by 20% and was adopted by the enterprise.

3.3.2. "Four-Stage Progressive" Practice System

Basic Practice (Freshman Year): On-campus metalworking practice + American virtual factory training

(through Herzing University's online platform).

Professional Practice (Sophomore Year): Participating in enterprise production line observation and auxiliary operations (such as the assembly workshop of Dongbei Group).

Comprehensive Practice (Junior Year): Undertaking enterprise technical service projects (such as equipment maintenance, process optimization).

Innovation Practice (Senior Year): Sino-US joint graduation design, with some students going to the United States to participate in cooperative projects between Herzing University and local enterprises.

3.3.3. Cultivation of Cross-Cultural Ability

The course "Comparison of Sino-US Engineering Cultures" is offered, and "Sino-US student online seminars" are organized to conduct debates on topics such as "green manufacturing" and "safety production" to improve students' cross-cultural collaboration ability. In 2022, the "solar-driven mechanical arm" project completed by the students of this major in cooperation with the team from Herzing University won the finalist award in the International College Students' Engineering Innovation Competition.

4. Reform Practice Effects and Reflections

4.1. Preliminary Effects

4.1.1. Improvement of Student Training Quality

In the past three years, the average employment rate of students in this major has increased from 90% to 96%, the local employment rate has risen from 35% to 62%, and the proportion of students entering leading enterprises such as Dongbei Group and Daye Special Steel has reached 38%.

The enthusiasm for international exchanges has increased: the number of students studying in the United States has risen from an average of 20 to 55 per year, Sino-US joint projects have won 3 international awards, and the passing rate of CET-4 for students has increased from 75% to 92%.

4.1.2. Recognition of Professional Construction

In 2023, it was approved as a "Hubei Provincial Demonstration Major for Sino-Foreign Cooperative Education". The practice base co-built with Huangshi enterprises was rated as a "Provincial College Students' Off-Campus Practice Education Base", and the talent training model case was included in the "Hubei Provincial Application-Oriented University Reform Case Collection".

4.2. Existing Challenges and Reflections

Difficulty in integrating resources from the US side: Herzing University has limited resources in the field of intelligent manufacturing. It is necessary to expand cooperation with universities in machinery powerhouses such as Germany and Japan to make up for technical shortcomings.

Insufficient in-depth participation of enterprises: Some small and medium-sized enterprises have low enthusiasm to participate in talent training due to cost concerns. It is necessary for the government to introduce incentive policies (such as tax reductions and exemptions).

Pressure on funding input: The cost of international faculty and practice platform construction is relatively high. It is necessary to explore a diversified investment mechanism of "tuition fees + enterprise sponsorship + government subsidies".

5. Conclusions and Prospects

The reform practice of the Mechanical Design, Manufacturing and Automation major (Sino-foreign cooperative education) in the School of Mechanical and Electrical Engineering of Hubei Polytechnic University shows that for mechanical majors in Sino-foreign cooperative education in local application-oriented universities, it is necessary to base themselves on the three attributes of "locality", "application" and "internationalization". Through the precision of training objectives, the integration of curriculum systems, the

projectization of teaching models, the double-qualification of faculty teams, and the diversification of quality evaluation, the transformation from "introduction to integration" and "theoretical to practical" can be realized.

In the future, the major will further deepen the collaboration with Huangshi industrial clusters, explore the "Sino-foreign cooperative education + industrial college" model, establish a "China-US-Europe" multilateral cooperation network, and strive to build a mechanical talent training base with "regional characteristics and international influence". It will provide replicable and promotable experience for the reform of Sino-foreign cooperative education majors in local application-oriented universities.

Funding

This work was supported by Key Projects of Hubei Provincial Natural Science Joint Innovation Fund (2023AFD002), Hubei Province Science and Technology Talent Service Enterprise Project (2024DJC022), The Teaching and Scientific Research Project of Hubei Polytechnic University (2022ZA28, 2023B03), Hubei Province Innovation & Entrepreneurship Training Program Project of the College Students (X202310920070, X202310920094, 202410920107).

Author Contributions

Writing—original draft, X.W. and S.W.; writing—review and editing, X.W. and S.W. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement

Not applicable.

Informed Consent Statement

Not applicable.

Data Availability Statement

Not applicable.

Conflicts of Interest

The authors declare no conflict of interest.

References

1 Ministry of Education. *Opinions of the Ministry of Education and Other Eight Departments on Accelerating and Expanding Education Opening-Up in the New Era*; Ministry of Education: Beijing, China, 2020.

2 Lin J, Liu Z. Construction and Practice of Quality Assurance System for Sino-Foreign Cooperative Education. *Journal of Higher Education* 2021; (**5**): 33–39.

3 Hubei Polytechnic University. *Hubei Polytechnic University's 14th Five-Year Plan for the Development of Education*; Hubei Polytechnic University: Huangshi, China, 2021.

4 Wang X, Li Z. Reform of Practical Teaching System for Mechanical Majors in Local Universities under the Background of Engineering Education Certification. *Research in Higher Education of Engineering* 2022; (**2**): 156–161.

5 Herzing University. *Mechanical Engineering Technology Program Handbook*; Herzing University: Milwaukee, WI, USA, 2023.

6 Chinese Mechanical Engineering Society. *Development Report of Mechanical Engineering Discipline (2022–2023)*; Science Press: Beijing, China, 2023.

7 Ministry of Education. O*utline of the Plan for Building a Powerful Education Country (2024–2035)*; Ministry of Education: Beijing, China, 2024.

8 Lin J. *Research on Quality Assurance System of Sino-Foreign Cooperative Education*; Educational Science

Press: Beijing, China, 2022.

9 Zhang Y. Innovation of Talent Training Mode for Mechanical Majors in Application-Oriented Universities. *Research in Higher Education of Engineering* 2023; (**2**): 145–150.

10 Wang J. Research on Curriculum Integration in Sino-Foreign Cooperative Education from the Perspective of Intercultural Education. *China Higher Education Research* 2022; (**8**): 78–83.