Research on the Construction of the Curriculum System for Industrial Engineering Major

De Wang, Xiaozhen Huang, Shuo Wang*

Guangdong Technology College, Zhaoqing, Guangdong, 526100, China

*Corresponding author. Email: wangshuo@gdlgxy.edu.cn

Abstract. Industrial engineering is an interdisciplinary field that combines engineering and management, with the core goal of enhancing production efficiency, optimizing resource allocation, and reducing production costs. In the current rapidly developing industrial environment, the industrial engineering discipline faces new challenges and opportunities. Therefore, it is particularly important to establish a scientific, reasonable, and up-to-date industrial engineering curriculum system. This paper first analyzes the construction principles of the industrial engineering curriculum system, then discusses the specific structure of the curriculum system, and proposes corresponding assessment standards and strategies for enhancing teachers' capabilities, with the aim of providing references for the development of the industrial engineering discipline.

Keywords: Industrial Engineering; Curriculum System; Production Efficiency; Industrial Environment

1 Introduction

Industrial engineering is a comprehensive interdisciplinary field that integrates knowledge from engineering technology, management science, and systems science[1]. Its core objective is to maximize production efficiency and minimize costs through the planning, design, implementation, and control of production systems[2]. With the transformation and upgrading of manufacturing and the development of intelligent manufacturing, the application of industrial engineering in the industrial sector is becoming increasingly widespread. To cultivate industrial engineers who can meet the demands of modern industry, it is necessary to conduct in-depth analysis and reform of the existing industrial engineering curriculum system to adapt to the requirements of the new era[3-4]. Based on the OBE concept and in combination with the characteristics of the industrial engineering discipline, a curriculum system that meets the development needs of new engineering disciplines should be constructed to provide theoretical support for cultivating industrial engineers with systematic thinking, digital capabilities, and innovative spirit[5-6].

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2 Principles for Constructing the Industrial Engineering Curriculum System

(1) Integration of Theory and Practice

The industrial engineering discipline emphasizes the integration of theory and practice, mainly cultivating students' ability to solve practical problems. Therefore, when constructing the curriculum system, it is necessary to ensure that theoretical courses and practical courses complement each other. On the one hand, theoretical courses should impart the basic principles, methods, and tools of industrial engineering; on the other hand, practical courses such as experiments, internships, course design, and research projects should enable students to apply the knowledge of industrial engineering in practice and enhance their hands-on abilities.

(2) Emphasis on both Forward-looking and Practicality

The field of industrial engineering is developing rapidly, with new technologies and methods emerging constantly. With the rapid development of AI, there is a higher demand for the learning ability of industrial engineering students. Therefore, the construction of the industrial engineering curriculum system should be forward-looking, incorporating emerging technologies and concepts such as intelligent manufacturing, big data analysis, and artificial intelligence. At the same time, the curriculum should maintain practicality to ensure that students can quickly adapt to the demands of the industrial sector and solve actual problems in enterprises after graduation.

(3) Interdisciplinary Integration

Industrial engineering is an interdisciplinary field that involves multiple areas such as mechanical engineering, management science, and computer science. Therefore, the curriculum system should emphasize interdisciplinary integration, broadening students' knowledge base and cultivating their comprehensive qualities and innovative abilities through interdisciplinary courses and projects.

(4) Enhancement of Humanistic Literacy

While emphasizing professional skills, the curriculum system should also focus on the cultivation of humanistic literacy. By offering humanities and social science courses such as national security education and engineering economics, students' comprehensive qualities and social responsibilities can be enhanced, laying the foundation for becoming well-rounded industrial engineers.

3 Structure of the Industrial Engineering Curriculum System

(1) Basic Courses

Basic courses serve as the foundation for students majoring in industrial engineering, laying the groundwork for subsequent specialized courses. These courses typically include advanced mathematics, college physics, introduction to computer science, management, and other fundamental disciplines. In advanced mathematics courses, students will learn linear algebra, statistics, and other subjects, providing mathematical tools for engineering analysis and optimization. Management courses enable students

to understand the basic principles and operation mechanisms of the market economy, providing a basis for cost-benefit analysis and market strategy formulation in industrial engineering.

(2) Core Specialized Courses

Core specialized courses are the essence of the industrial engineering major, aiming to cultivate students' professional knowledge and skills. These courses typically cover basic industrial engineering, lean production, quality management and reliability, human factors engineering, cost control, production planning and control, facility planning and logistics analysis, etc. Facility planning and logistics analysis courses mainly cultivate students' abilities to design, optimize, and manage production systems. Human factors engineering courses study the interaction between humans and systems, aiming to improve system safety and efficiency. Quality management and reliability courses teach students skills such as quality control, quality improvement, and quality assurance, ensuring the quality of products and services.

(3) Elective Courses for Specialization

Elective courses aim to broaden students' knowledge and interest range, providing diverse learning options. Specialization elective courses include advanced manufacturing technology, data analysis and big data, intelligent manufacturing technology, etc. Advanced manufacturing technology courses introduce the latest manufacturing technologies, such as additive manufacturing and precision processing, allowing students to understand the cutting-edge technologies in the industrial field. Data analysis and big data courses teach students skills in big data processing, data mining, and analysis, providing support for data analysis in industrial engineering. Intelligent manufacturing technology courses focus on the design and implementation of intelligent manufacturing systems, cultivating students' mastery of intelligent manufacturing technologies and management capabilities.

(4) Practical Components

Practical components are an important part of the industrial engineering course system, aiming to cultivate students' practical abilities and innovative thinking. These components include in-course experiments, course design, enterprise internships, and graduation projects. Experimental courses allow students to verify theoretical knowledge through experiments and master experimental skills. Graduation projects require students to comprehensively apply the knowledge and skills they have learned to complete a project with practical significance, cultivating students' innovative abilities and problem-solving skills.

4 Evaluation Standards for the Industrial Engineering Course System

(1) Knowledge Mastery

The degree of knowledge mastery is an important indicator for evaluating the effectiveness of the industrial engineering course system. Through examinations, assignments, and course design, the mastery of basic and specialized knowledge by students can be assessed. Examinations can test students' understanding and memory of

theoretical knowledge; assignments help students consolidate what they have learned and improve their application abilities; course design requires students to comprehensively apply the knowledge they have learned to solve practical problems, cultivating design abilities and innovative thinking. At the same time, data such as students' feedback and grade distribution can be analyzed to assess the difficulty level and teaching effectiveness of the course content, providing a basis for the optimization of the course system.

(2) Cultivation of Practical Abilities

Practical ability is one of the core competencies that industrial engineering students must possess. Therefore, the assessment criteria for the curriculum system should include the evaluation of students' practical abilities. Through experimental operations, internship performances, and project practices, students' hands-on abilities and problem-solving skills in real-world scenarios can be evaluated. Experimental operations can test students' mastery of experimental skills and principles; internship performances can reflect students' work attitudes and practical operation abilities in enterprises; project practices require students to participate in the design and implementation of actual projects, cultivating their teamwork and project management skills. Additionally, data such as enterprise feedback and project outcomes can be used to assess students' practical abilities and the practical teaching effectiveness of the curriculum system.

(3) Comprehensive Quality Evaluation

In addition to professional knowledge and skills, industrial engineering students should also possess good comprehensive qualities, including communication skills, teamwork abilities, and leadership. Therefore, the assessment criteria for the curriculum system should also include the evaluation of students' comprehensive qualities. Through classroom discussions, classroom performances, team projects, and social practices, students' communication and teamwork abilities can be assessed. Classroom discussions encourage students to express their viewpoints, cultivating their expression and critical thinking skills; team projects require students to complete tasks together, fostering their teamwork and leadership abilities; social practices allow students to participate in social services or public welfare activities, cultivating their sense of social responsibility and citizenship. At the same time, comprehensive understanding of students' comprehensive qualities and the comprehensive quality cultivation effectiveness of the curriculum system can be achieved through self-evaluation, peer evaluation, and teacher evaluation.

5 Strategies for Enhancing the Capabilities of Industrial Engineering Teachers

(1) Continuous Learning and Professional Development

The field of industrial engineering is developing rapidly, with new technologies and methods emerging constantly. Therefore, teachers in the industrial engineering discipline need to maintain a continuous learning attitude and constantly update their knowledge and skills. Participating in academic conferences, seminars, and training

courses, etc., to stay informed about the latest research results and industry trends; reading academic papers and journals in related fields to master the latest theories and technologies; collaborating with enterprises on research projects to understand the actual needs and technical challenges in manufacturing. Through continuous learning and professional development, teachers can continuously improve their teaching and research capabilities, providing students with higher-quality teaching resources and services.

(2) Innovation in Teaching Methods and Approaches

Innovation in teaching methods and approaches is an important way to improve teaching quality. Teachers in the industrial engineering discipline should actively explore and apply new teaching methods and approaches to stimulate students' interest and enthusiasm for learning. For example, adopting interactive teaching methods such as case-based teaching and project-based teaching, allowing students to learn and master knowledge through practice; at the same time, utilizing multimedia technology, Rain Classroom, online and offline first-class courses, course resource libraries, and self-built courses, etc., to break through traditional teaching methods and approaches, thereby enhancing the interest and interactivity of the classroom. (1) Developing new teaching models such as online courses and blended learning can meet students' diverse learning needs. Through innovation in teaching methods and means, teachers can enhance teaching effectiveness and learning experience, and cultivate students' autonomous learning ability and innovation ability.

(3) Accumulation of Practical Experience

The industrial engineering major emphasizes the integration of theory and practice, so teachers need to have certain practical experience. Teachers can accumulate practical experience through participating in enterprise projects, internship guidance, and industry-university-research cooperation. Participating in enterprise projects enables teachers to understand the actual needs and technical challenges in the manufacturing industry, improving their practical ability and problem-solving skills; internship guidance allows teachers to understand students' performance and needs in practice, providing targeted guidance for teaching; industry-university-research cooperation promotes collaboration and communication between teachers and enterprises, facilitating the transformation and application of research results

(4) Team Collaboration and Communication

Team collaboration and communication are important ways to improve teachers' teaching ability. Teachers in the industrial engineering major can collaborate and communicate with teachers from other disciplines, industry experts, and enterprise personnel to jointly conduct teaching research and scientific research projects. At the same time, team collaboration and communication can also enhance teachers' sense of belonging and cohesion, and improve the collaboration and competitiveness of the entire teaching team.

6 Conclusion

Constructing a scientific, reasonable, and up-to-date curriculum system for the industrial engineering major is the key to cultivating industrial engineers who can adapt to modern industrial needs. By following the principles of integrating theory and practice, emphasizing both forward-looking and practicality, modularization and flexibility, cross-disciplinary integration, and strengthening humanistic literacy, a curriculum system structure combining basic courses, core professional courses, elective courses, and practical links can be established, and assessment standards for knowledge mastery, practical ability cultivation, innovation ability cultivation, and comprehensive quality evaluation can be formulated to comprehensively evaluate students' learning outcomes and the effectiveness of the curriculum system.

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