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Reform of Industry Education Integration Teaching in Equipment Manufacturing Majors from the Perspective of Promoting Education through Competition

Yunfei Liao *

School of Rail Transit and Aviation Service, Chongqing Industry Polytechnic College, Chongqing China

* Corresponding Author

Abstract. At present, with the changes in teaching indicators in vocational colleges, various skills and subject competitions have become important ways to evaluate school teaching and student quality. Reconstruct teaching quality evaluation standards by combining competition evaluation standards with teaching practice; Revise daily teaching quality supervision and assessment standards based on core observation elements such as teaching design, teaching implementation, and evaluation in competitions; The construction of a teaching quality standard system that inherits concepts and policies, and connects characteristics and reality has become an important content of current vocational education. On the basis of systematically elaborating on the importance of competition course integration, this article proposes an implementation plan for competition course integration in accordance with the curriculum settings and corresponding relationships of manufacturing majors.

Keywords: Vocational Skills Education; Integration of Competitions and Courses; Teaching Reform.

1. Introduction

Vocational education is closely related to economic construction, and serving and supporting industrial transformation and upgrading is the fundamental foundation of vocational education. A significant feature of the National Vocational College Skills Competition is that the event settings are closely linked to production reality and industry hotspots, timely reflecting regional economic development trends and enterprise needs. It can be said that the competition has become a wind vane for industrial transformation. By setting up events, one can perceive changes in the industry, and at the same time, by perceiving changes in the industry, one can adjust the setting of events in turn, forming a virtuous cycle [1].

2. The Significance of Integrating Industry, Competition, and Education

Simply put, "integration of industry and education" refers to the integration and integration of two different fields of industry and education. Since the "Opinions of the Ministry of Education on Deepening the Comprehensive Reform of the Education Sector in 2013" first proposed the improvement of the "industry education integration" system in vocational education, the "industry education integration" has been continuously deepening in policy, research, application, and practice, aiming to improve the quality of talent cultivation faster and better serve the development of the industry through the full integration of talents, projects, technology, information, resources, and other aspects between the education and industry sectors, The ultimate solution to the disconnect between talent cultivation and industrial demand. The theoretical research on the integration of industry and education to a certain extent explains the relationship between industry and education, as well as the supply-demand relationship between the industry demand side and the education supply side, which is the logical relationship chain of "teaching after production" and "promoting production through education".

As another fundamental task, "integration of competition and education" aims to effectively integrate competition and educational reform through "promoting education through competition, learning through competition, and reform through competition". It integrates competition related content, norms, systems, etc. into the process of talent cultivation, practical teaching, curriculum construction, and other teaching reforms, in order to promote vocational education teaching reform. The simple explanation of "integration of competition and education" indicates the supply and demand relationship between the education demand side and the skill competition supply side, namely the logical relationship chain of "teaching first, competition later" and "promoting education through competition"[2].

3. The Significance of Integrating Industry, Competition, and Education

Equipment manufacturing majors mainly cater to professions such as mechanical design engineering technicians, mechanical manufacturing engineering technicians, and quality management engineering technicians, as well as positions (groups) such as mechanical design, process planning, CNC programming and machine tool operation, and quality inspection. Students are required to have a solid scientific and cultural foundation, as well as knowledge of mechanical product and its component design, digital design, mechanical processing and CNC technology, tolerance fit and measurement, mechanical and electrical equipment control and maintenance. They should possess the abilities of mechanical system, mechanical component structural design and optimization, manufacturing process preparation, product quality inspection, equipment debugging and maintenance, and possess the spirit of craftsmanship and information literacy. They should be able to engage in product structural design Digital design, mechanical processing, part manufacturing process planning, product inspection and quality control, and other work.

In terms of curriculum, it is generally divided into three categories: professional basic courses, professional core courses, and internship training courses. Some typical courses are as follows:

Professional basic courses: Mechanical Drawing and Computer Drawing, Tolerance Fit and Measurement Technology, Engineering Mechanics, Engineering Materials and Thermoforming Technology, Electrical and Electronic Technology, Hydraulic and Pneumatic Transmission.

Professional core courses: Fundamentals of Mechanical Design, Fundamentals of Digital Design, Mechanical System Design, 3D Product Modeling and Structural Design, Mechanical Manufacturing Technology, CNC Processing Programming and Operation, and Precision Measurement Technology.

Internship training: Connect with real professional or work scenarios, and conduct basic training in mechanical engineering, mechanical design course design, mechanical component surveying and mapping, hydraulic and pneumatic component selection and system design, CNC programming and CNC machine tool operation, mechanical machining process planning and fixture design, precision measurement technology, industrial robot programming and simulation, both on and off campus. Conduct job internships in mechanical design and industrial product manufacturing enterprises in the equipment manufacturing industry.

4. Correspondence between Courses and Events

Under the guidance of industry education integration and competition education integration, various competitions are being carried out in full swing. There are over a hundred manufacturing competitions alone. In the 2023 National College Student Subject Competition List, there are 25 major competitions related to manufacturing majors, among which the National Vocational College Skills Competition, World Skills Competition, and other competitions each contain over a hundred sub items. Through research, it has been found that most events are closely related to the corresponding courses. The following table provides examples of some typical courses and events.

Table 1. Correspondence between some courses and events

Course name	Corresponding events
Mechanical Drawing and Computer Drawing, Product 3D Modeling and Structural Design, Fundamentals of Digital Design	National College Student Advanced Mapping Technology and Product Information Modeling Innovation Competition
Advanced Mathematics, Probability and Statistics, Linear Algebra, Computer Programming and Applications	National College Student Mathematical Modeling Competition
Mechanical Drawing and Computer Graphics, Fundamentals of Mechanical Design, Fundamentals of Digital Design, Mechanical System Design, Product 3D Modeling and Structural Design	National College Student Mechanical Innovation Design Competition
Electrical and electronic technology, hydraulic and pneumatic transmission, control engineering, PLC	Siemens Cup China Intelligent Manufacturing Challenge
Fundamentals of Mechanical Design, Fundamentals of Digital Design, Mechanical System Design, 3D Product Modeling and Structural Design	China University Mechanical Engineering Innovation and Creativity Competition
Mechanical Drawing and Computer Graphics, Fundamentals of Mechanical Design, Fundamentals of Digital Design, Mechanical System Design, Product 3D Modeling and Structural Design	National College Student Industrial Design Competition
Internship and training courses	National Vocational College Skills Competition

Obviously, there is a significant correspondence between courses and events, and there are often intersections and overlaps. For the integration of events and courses, Rizhao Vocational College has conducted beneficial explorations[3]. They rely on professional groups to research, decompose, and extract competition projects, identify corresponding knowledge and skills, develop and form teaching resources, such as writing technical manuals for competition equipment or platforms, organizing and analyzing competition question answers, establishing skill training project libraries, and further transforming them into course content, gradually establishing a "national provincial city school competition" resource system. Based on the "Internet plus" platform, electronic resource training packages such as competition rules, competition question bank, digital teaching materials, training videos, etc. will be formed, and technical skills training will be carried out for subsequent participants and teachers to improve the overall skill level of students. For example, the Department of Mechanical and Electrical Engineering has established a resource library by combining the two competitions of "Modern Electrical Control System Installation and Debugging" and "Automatic Production Line Installation and Debugging", adjusted the course system, and integrated six core courses such as "PLC Control System Installation and Debugging". The competition resources have been integrated into practical training projects, and more emphasis has been placed on student skill development and assessment to help students solve practical problems and achieve good training results.

5. Implementation Plan

In practice, some scholars have proposed specific implementation plans.

5.1. Integration of Events and Course Content

Guided by the content of the competition, with classroom teaching content as the main body, form a teaching model of "learning by competition, learning by competition". Transform the competition into multiple project tasks, combine them with classroom teaching content, and divide the course content for teaching.[4]. Through the "project teaching method", the classroom teaching content is project-based into innovation and entrepreneurship projects, enabling the project team to experience the entrepreneurial practice process in market analysis, product service design, marketing planning, company operation, financial analysis, and result reporting. Build a multi-disciplinary resource library for scientific and technological innovation and entrepreneurship practice projects, starting from professionally supported innovation and entrepreneurship projects, integrating competitions into teaching, and achieving the goal of promoting teaching through competitions[5].

5.2. Integration of Event and Course Organizational Forms

Students use projects as a carrier and simulate the competition process through team building; Conduct group simulations while engaging in group competitions between different groups to compete the course content; Clear division of labor within the group, integration of students from multiple majors, participation of everyone, and task indicators for everyone, and rolization of project tasks; Integrate entrepreneurial theory into project practice, provide templates for business solutions, and systematize theoretical knowledge. Jumping out of the traditional classroom mode, making the competition vividly reproduce the entire cycle and process in the classroom, introducing external scene resources, and creating a new paradigm of competition course integration [6].

6. Conclusion

Subject competitions are an important link and powerful tool for testing teaching achievements and improving students' innovative abilities. The school encourages teachers and students to actively participate in various subject competitions and activities, promoting learning through competitions, strengthening competitions through learning, stimulating students' interest and potential, and cultivating students' scientific research ability and innovative spirit. Strengthen peer cooperation and guide lower grade students in competitions, gradually forming a good situation of mutual promotion and development between students and competition teams; Promote teaching through competitions, assist teaching with competitions, integrate competitions into professional teaching, strengthen the combination of subject competitions and related course construction, guide students to participate in project assisted research around subject competitions, and continuously promote the reform of teaching content and methods.

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