Curriculum Ideological and Political Teaching Reform under the Mode of Post Course Competition Certificate Accommodation-Take "Machinery Manufacturing Technology" as an Example

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Abstract. Highly skilled talents have emerged as a crucial strategic resource for the nation, and their cultivation is an inevitable choice for vocational education to achieve high-end development and optimize the talent structure. To enhance the adaptability of vocational education and foster high-quality, versatile, and innovative skilled personnel, there is an urgent need to innovate educational models that embody the characteristics of vocational types. "Curriculum-based ideological and political education" (hereinafter referred to as "curriculum ideology") represents a new requirement of the Party Central Committee for strengthening ideological and political work in universities under the new era, and its development in higher education holds significant importance. Integrating ideological and political elements into specialized courses should be grounded in the fundamental questions of "what kind of people to cultivate, how to cultivate them, and for whom to cultivate them," guiding students to establish correct occupational, life, and value outlooks. Traditional approaches to curriculum ideology, which often involve teacher-led lectures with limited student engagement, have struggled to generate enthusiasm or resonate with students. This project, guided by the integration of "post-course-competition-certification" thinking, seamlessly incorporates ideological and political elements into the core course of "Mechanical Manufacturing Technology" for numerical control technology majors. Based on existing faculty strength, student backgrounds, teaching resources, and practical training conditions, a new multi-integrated project-based teaching system is established.[1]

Keywords: Mechanical Manufacturing Technology; Job requirements; Certificate of skills; Skill competition

1 INTRODUCTION

"Mechanical Manufacturing Technology" serves as a core course for majors in mechanical manufacturing and numerical control technology, encompassing topics such as engineering material selection, metal cutting tools, and machining processes. The

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primary objective of this course is to equip students with the competency to select metallic materials and processing machines, as well as the ability to devise machining processes.[2]

2 OVERALL DESIGN OF THE TEACHING REFORM PLAN

2.1 Reform of Teaching Content

The comprehensive education model of "post-course-competition-certification" is theoretically supported by "cross-border integration theory" and "system integration theory," breaking down barriers between education and industry, schools and enterprises, and exhibiting features of diversity, cross-border, and integration. It organically integrates enterprise job resources, school curriculum resources, skills competition resources, and the training and assessment resources of vocational qualification certificates. The organic integration of ideological and political elements into "post-course-competition-certification" serves as the necessary foundation for the teaching method of "integrating ideological and political education into comprehensive education." See Figure 1.

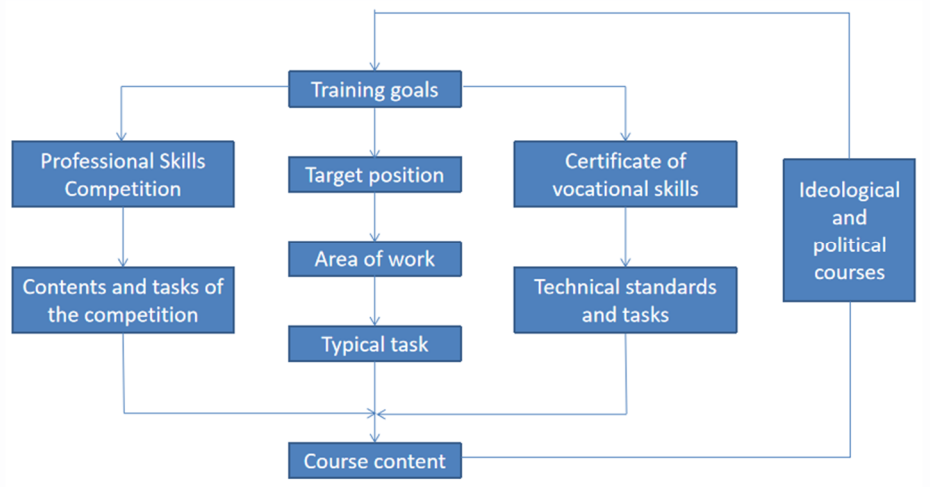

Fig. 1. Multi-agent Collaborative Curriculum Structure

The key to comprehensive education through "post-course-competition-certification" lies in integration, which does not simply concatenate or add up the requirements, contents, and standards related to "post," "course," "competition," and "certification." Rather, it connects these elements into a unified whole. This necessitates a curriculum reform that is logically grounded in education, integrating "post," "course," "competition," and "certification" through the setting of norms and standards, fusing enterprise job requirements, skills competition content and standards, and vocational certificate

content and requirements with curriculum construction, thereby achieving deep integration between the "industrial field" and the "educational field," as well as the duality of the "production field" and the "learning field," ultimately aiming at "comprehensive education."[3] See Figure 2.

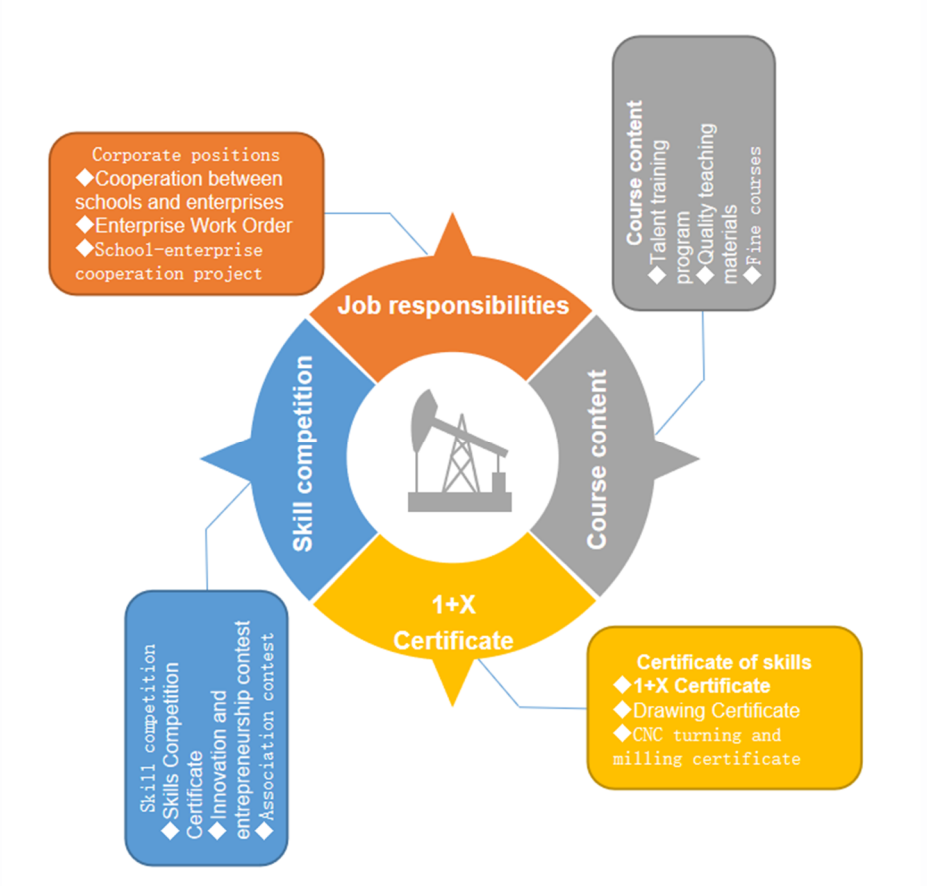

Fig. 2. Integrated Design of Post-Course-Competition-Certification

3 TEACHING REFORM OBJECTIVES

The comprehensive education model of "post-course-competition-certification" effectively connects and integrates relevant standards, contents, and processes from work positions, curriculum systems, skills competitions, and vocational certificates, enabling course design based on job positions, course promotion through competitions, course enrichment with certificates, and talent cultivation through courses. This approach imbues coursework with a harmonious blend of theory and practice, fostering skilled technicians who excel both morally and technically, integrating work and study. Course

standards are revised based on the contents and requirements of "post-competition-certification," deeply integrating them into the curriculum. Ideological and political education is seamlessly woven into teaching designs, forming a novel teaching plan aligned with job functions. Furthermore, diversified teaching evaluation methods integrating ideological and political education are refined.

4 SPECIFIC IMPLEMENTATION OF THE TEACHING REFORM PLAN

4.1 Implementation Plan

Integration of "Post-Competition-Certification" into Curriculum Construction. To improve the overall quality of teachers, enhance teaching ability, improve the rate of double teachers, improve the rate of excellence in teaching evaluation, and encourage teachers to participate in teaching competence-related competitions. To delve into and study students' abilities and qualities, teachers should establish harmonious teacher-student relationships, understand students' learning habits, and hobbies, and provide targeted guidance. The teaching team organizes visits to enterprises for students, conducts job position research, understands the demands of job positions, and formulates talent training programs by incorporating the content related to skill competitions and vocational certificates. Students are encouraged to participate in vocational skill competitions and obtain relevant occupational certificates. By adopting the topics of skill competitions and the contents of vocational certificate examinations as cases, classroom teaching tasks are introduced. Evaluation tools are fully utilized to comprehensively assess students' learning outcomes and the development of their ideological and political qualities throughout the course. Classroom teaching tasks are introduced by taking skills competitions and vocational certificate examinations as examples. Full use of evaluation tools, the whole process of an all-round evaluation of student learning and the development of ideological and political quality of the curriculum.

Introduction of Ideological and Political Elements into Curriculum Resources. Teaching team members reorganize the curriculum structure by conducting job demand research, aligning it with course content and characteristics, and creating new course resources such as slideshows, micro-lectures, 3D models, and physical models. The curriculum's ideological and political elements are reconstructed based on the Party's constitution and glorious history.[4]

4.2 Implementation Methods

Tailored to the project's unique features and anticipated objectives, the following research methods are employed: enterprise research, case studies, and comparative analysis.

Enterprise Research Method. Course team members conduct job demand research in neighboring enterprises, such as Zhuhai Dongrong Metal Products Co., Ltd., which specializes in metal product processing, mold design and manufacturing, and metal surface treatment. Based on the findings, the team optimizes the talent cultivation plan for the numerical control major, enhancing the alignment between students and job positions, and improving employment rates.

Case Study Method. Team members collect actual enterprise projects, such as the production of machine tool door handles by Zhuhai Dongrong Metal Products Co., Ltd., integrating content from vocational skills competitions (e.g., mold digital design and manufacturing process competition tasks in the Guangdong Vocational College Skills Competition) and 1+X NC Lathe and Milling Certificate assessments. Through in-depth analysis, the team formulates practical course cases that incorporate ideological and political elements.

Comparative Analysis Method. By comparing the practices and outcomes of "post-course-competition-certification" integrated ideological and political education between our institution and other vocational colleges within the province, we draw on successful experiences to develop a curriculum uniquely tailored to our needs.

4.3 Course Ideological and Political Design

Mechanical Manufacturing Technology is one of the core courses for engineering majors, which aims to train students to master the basic theory, technology, equipment operation and quality control skills of modern mechanical manufacturing. Under the background of "Course ideology and politics", this course not only pays attention to the teaching of professional knowledge and the training of skills, more emphasis will be placed on integrating ideological and political elements such as socialist core values, craftsmanship, innovative consciousness and professional ethics into the teaching process, the purpose is to train high-quality talents with national feelings, international vision, innovative spirit and social responsibility in the field of machinery manufacturing. The ideological and political content into the classroom to complete the ideological and political design of the curriculum. The introduction of industry leaders in theoretical courses, to show students the invaluable spirit of labor, to achieve knowledge goals. In the practical course, the strength of assessment, for example, every size of each workpiece, should be measured at least three points, to ensure the accuracy of data, to enhance students' craftsmanship, skills and quality training.[5] See Table 1.

Table 1. The main case of course ideology and politics

Project	Objectives	Mission	Ideological and political case
Engineering materials	Never slack labor morality	Selection of non-metallic materials	"Crystal king"-Wang Yuancheng

		Selection of non-ferrous metal materials	"National model worker"-Liu Yonggang
		Selection of ferrous metal materials	"A keen eye"-Yang Jinan
Material forming method	Love the industry	Castings	"Master of casting"-Mao Lasheng
		Forgings	"Great country craftsman"-Liu Boming
		Profile	Domestic automobile chassis
		Welding parts	Rocket welding-Gao Fenglin
Metal cutting tools and machine tools	Love the home and country feelings	Tool geometric parameters and selection	"Gunpowder sculptor"-Xu Liping
		Classification and selection of cutting machine tools	"Metal carving artist"-Hu Sheng
Selection and design of machine tool jigs	Have the courage to contribute to the spirit of model workers	General Purpose Machine Tool fixture	Chief Skills Specialist in the aviation industry-Qin Shijun
		Special fixture for machine tool	Astronauts in Space Station
Calculation of process dimension	The spirit of craftsmanship	Residual method	"National skilled worker"-Zhao Jing
		Process dimension chain method	"National skilled worker"-Song Fulin
Machining process regulations	Model worker	Process analysis of parts	"National skilled worker"-Chen Jingyi
		Process planning	"National skilled worker"-Wang Wei
		Process documentation	"National model workers"-Li Shuqian
Machining quality	The pursuit of quality	Analysis of machining quality	Fitter technician-Yin Qiuliang

In addition to the above-mentioned ideological and political integration point, the following aspects of ideological and political integration point design: patriotic feelings and industrial confidence: introduce the development of China's machinery manufacturing process, especially in recent years in high-end equipment manufacturing, intelligent manufacturing and other areas of major breakthroughs and achievements, such as high-speed rail, aerospace, new energy vehicles and other fields of success. Innovation consciousness and scientific research spirit: combine the cutting-edge technology in the

field of mechanical manufacturing, such as 3D printing, robot technology, intelligent manufacturing system, etc. . Professional Ethics and Social Responsibility: introduce professional ethics cases in the field of machinery manufacturing, such as work safety accidents, product quality problems, etc. , strengthen the safety awareness and quality awareness of students. Craftsmanship and excellence: when explaining the process of precision machining, assembly and debugging, we emphasize the meaning of craftsmanship, that is, focus, Patience, excellence attitude

5 FEASIBILITY ANALYSIS

Collaborative education fosters a closed-loop optimization of professional competency structures, enhancing the fit with job clusters. A professional group construction committee is established to regularly monitor and analyze job quality requirements, competency requirements, and evaluation standards, dynamically optimizing students' individual, social, and professional abilities. This provides a solid foundation and robust support for the project.

The project leader, with years of experience in corporate technology and management, possesses abundant practical and teaching experience, effectively bridging the gap between jobs and courses. Other team members, including teachers with extensive experience in heavy machinery manufacturing and robust research capabilities, as well as accomplished instructors from the Robotics Institute, contribute significantly to the project's success.

The course of mechanical manufacturing technology requires mastering the basic skills of machine tool operation, process execution, quality control, etc. Knowledge of quality inspection, process control, quality management system, familiar with machine maintenance, fault diagnosis and removal, equipment upgrading and transformation skills. Machining industry, cutting processing occupies an important position, docking the needs of the industry, select the actual project cases into the teaching, guide students to find ways to solve problems, to complete the tasks of the course project, from which to obtain relevant knowledge points. According to the actual project, organize students to complete the whole process from requirement analysis, process design to process implementation and quality inspection, and simulate the real work scene. The circulation model of“Learning-practice-re-learning” is adopted to make students alternately study in school and practice in enterprises, and to promote the transformation of knowledge to skills.

Truly achieve student-oriented, teacher-assisted teaching methods. The class guide students through hands-on practice, scenario simulation and role exchange, learn to ask questions, analyze and solve problems. “Learning by doing, learning by doing” is no longer a slogan, the real student hands-on to do into the classroom education, practice activities become the best way to internalize the spirit of craftsmanship. Through to the related profession leader's understanding, trains loves the post to be dedicated to the work the craftsman spirit.

6 CONCLUSION

Mold competitions in vocational skills contests primarily assess students' ability to independently design molds. NC lathe and milling operations, a crucial aspect of mold competitions, involve knowledge such as workpiece installation and alignment, tool installation and adjustment, processing data transmission, tool library establishment, and cutting parameter application. Participating in these competitions helps students enhance and consolidate their tool-related knowledge, discovering deeper meanings of tool parameters in solving practical problems. Encouraging student participation in such competitions elevates their learning enthusiasm. In the 2021-2022 Guangdong Vocational College Skills Competition, NC technology majors secured the group first prize, and in the 2022 National Vocational College Skills Competition, they achieved the group third prize. See Figure 3.

Fig. 3. Vocational Skills Competition Certificate

The 1+X NC Lathe and Milling Certificate serves as a valuable asset for NC majors entering the workforce, offering a new employment direction and high recognition. Encouraging and assisting students to obtain this certificate effectively boosts their learning motivation and outcomes. In 2022, 100% of NC technology majors passed the 1+X Vocational Skills Certificate (NC Lathe and Milling) exam, with Guangdong Polytechnic of Science and Technology honored as an outstanding pilot institution. See Figure 4.


Certificate

荣誉证书

HONORARY CREDENTIAL

Guangdong Polytechnic of Science and Technology

广东科学技术职业学院：

在2022年1+X职业技能等级证书试点考核工作中贡献突出，荣获

Outstanding contribution to the pilot assessment of 1+X vocational skill level certificates, Won the excellent pilot college

优秀试点院校

特发此证，以资鼓励。

This certificate is hereby issued for encouragement

Wu Han Huazong CNC

武汉华中数控股份有限公司

2023年3月7日

March 7, 2023

Fig. 4. 1+X Outstanding Pilot Certificate

Comparing the final exam results of the Mechanical Manufacturing Technology course between the first and second semesters of 2021-2022, the pass rate increased significantly, with the number of students failing dropping from 31 to 8, and the number of students scoring above 90 rising from 0 to 6.

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