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Research on Modular Teaching of the Course of CNC Lathe Processing Technology for Typical Parts

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Abstract: CNC lathe processing technology for typical parts is a core professional course for NC technology majors. At present, the teaching mode of this course has the problems of teaching objectives being separated from the requirements for training applied innovative talents, one-sided teaching contents and single teaching methods. Based on the new engineering curriculum construction standard, taking the engineering education professional certification as an opportunity, we should define the teaching objectives of this course, reconstruct the teaching content, innovate the teaching methods, explore the student centered modular teaching mode, guide students to think positively, cultivate their engineering awareness and innovative thinking, shape the spirit of professional craftsman who strives for perfection and pursues excellence, so as to achieve the training objectives of numerical control technology and applied innovative talents.

1. Introduction

In the context of the country's vigorous development of vocational education, many researches in the reform of in-service education are carried out around talent training mode, curriculum standards, teaching ability, curriculum system and evaluation methods [1]. There is still a lack of research on the curriculum. The modular teaching of curriculum is a popular model of vocational education in recent years. Especially in the development process of online courses of high-quality resources, the modular teaching content is more suitable for learners at different levels to quickly acquire knowledge [2-4].

There are two perspectives of research, one is the construction of modular curriculum system, the other is the reform of modular curriculum teaching. Among them, the research focus on the construction of modular curriculum system is to connect with the actual work, analyze and sort out the post (group) ability needs and theoretical knowledge system, take the ability as the guidance, break the discipline system and curriculum boundaries, reconstruct the professional curriculum system and modularize it, focus on the construction of interdisciplinary modules, and lay the foundation for the cultivation of composite technical skills [5-7]. The research focus of curriculum modular teaching reform is to establish curriculum teaching objectives, integrate and reconstruct curriculum teaching content, screen knowledge points and skill points based on competency

orientation and modularize them, and highlight the cultivation of students' post abilities, taking post professional abilities as the guidance [8-12]. Although the construction of modular curriculum system and the reform of modular curriculum teaching belong to two different levels, they both follow the basic concept of modular teaching reform.

In terms of the research on modular teaching reform in the field of domestic vocational education, there are mainly two problems. First, the ability orientation of curriculum system and curriculum content modularization is not clear enough. The main problem is that the corresponding relationship between the modularization of the curriculum system and the professional ability structure is not clear, and the corresponding relationship between the modularization of the curriculum content and the post ability is not clear. The main reason is that the post (group) capacity structure linking the production process or working process as the basis of the practice and research of modular teaching reform has not been established. Many researches on curriculum modular teaching reform have not only failed to establish post competency structure, but also failed to sort out and screen knowledge points and skills points based on competency orientation in curriculum content, so the competency orientation of curriculum modularization is not clear. Second, the dimensions of the research on the practice of modular teaching reform are relatively single, and the teaching reform based on competency orientation is not strong enough. The main problem is that many modular teaching reforms pay too much attention to the modularization of the curriculum system or the modularization of the curriculum content, and neglect the practice and research of the ability oriented curriculum teaching design, teaching process reform, teaching method reform and other aspects, and the combination of the curriculum modularization research and the ability oriented teaching reform practice is not close enough.

2. Curriculum Modular Design Ideas

The core idea of the curriculum design is "post course competition certificate" integration. According to the ability requirements of the enterprise post, the school and enterprise cooperate to jointly develop the talent training program and curriculum system of NC specialty. In combination with the latest national standard of CNC lathe processing technology, according to the talent training program, we worked with XX enterprise technicians to formulate curriculum standards, connect typical job tasks, build the curriculum into eight skill modules based on the teaching plan and syllabus, and reorganize the knowledge system into project driven teaching. The training level of students will be improved and integrated into the "1+X" certificate based on the numerical control contest questions.

During the course content organization and implementation, the principles of "application as the purpose", "necessity and sufficiency as the degree", "mastering the foundation, strengthening the application, cultivating skills, and cultivating literacy" as the teaching focus, "typical parts of enterprises" as the carrier, through the task led modular teaching, students' theoretical knowledge, drawing awareness, and processing process document formulation ability are comprehensively cultivated, and students' dedication "Craftsman" spirit in lean, focused and innovative aspects. At the same time, according to the analysis of learning situation, follow the cognitive and learning rules, and carry out teaching activities with students as the main body from simple to deep.

3. Modularization of the Course NC Lathe Processing Technology for Typical Parts with Enterprise Parts as the Carrier

3.1. Course Structure Design

NC Lathe Processing Technology for Typical Parts is mainly for the equipment manufacturing

industry to train professional and technical personnel for CNC lathe programming, CNC lathe technology, CNC lathe operation and other posts. At the same time, by optimizing the curriculum and teaching content, the course strengthens the practical training of CNC lathe, providing strong support for the "1+X" certificate system of CNC technology specialty.

This course takes the typical parts of enterprises as the carrier and results oriented as the core to create five projects, which are respectively: basic operation of CNC lathes, CNC programming and processing of spindles, CNC programming and processing of flanges, CNC programming and processing of dust boots, CNC programming and processing of half shaft bushings, one practical strengthening project, and several case libraries and task tests. See Figure 1 for details.

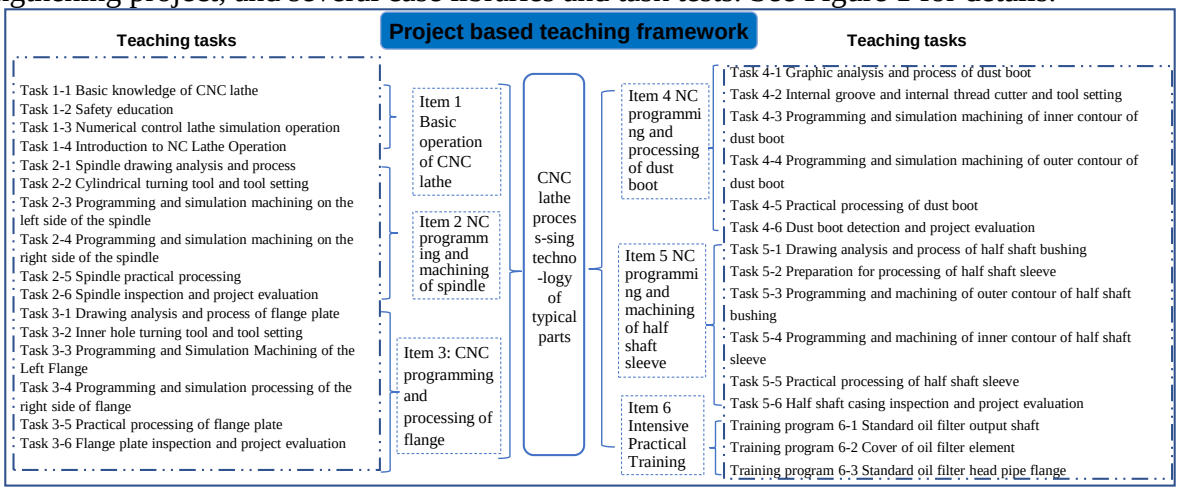

Figure 1: Curriculum Structure Framework

The innovation of the course in teaching mode is shown in: introducing online and offline hybrid teaching, realizing the integrated teaching mode of teaching, giving full play to the comprehensive application of various teaching methods and advanced information technology, bringing enterprise production scenarios into the classroom, using classroom knowledge in the production site, and truly realizing the seamless connection of "dual classroom".

3.2. Ideological and Political Integration of Courses

Inspire students' desire for learning this course through "family and country feelings", show the spirit of labor glory and dedication with "model worker spirit", and finally complete the practical training with the attitude of "craftsman spirit". As shown in Figure 2.

The ideological and political education will be integrated into the NC lathe processing technology classroom of typical parts, combined with the teaching content of professional courses, to find the right combination point and entry point, and promote the organic combination of "teaching" and "educating". It cultivates students' patriotism, integrity, dedication, quality awareness and other excellent qualities, enhances students' sense of national industrial responsibility and sense of mission, and enables students to have excellent professional ethics and superb professional skills. The content of "the development of China's national industry and cultural construction" will be included in the teaching content, so that students can understand China's industrial history, stimulate students' strong national self-esteem and self-confidence, and form a sense of responsibility and mission for the revitalization of national industry.

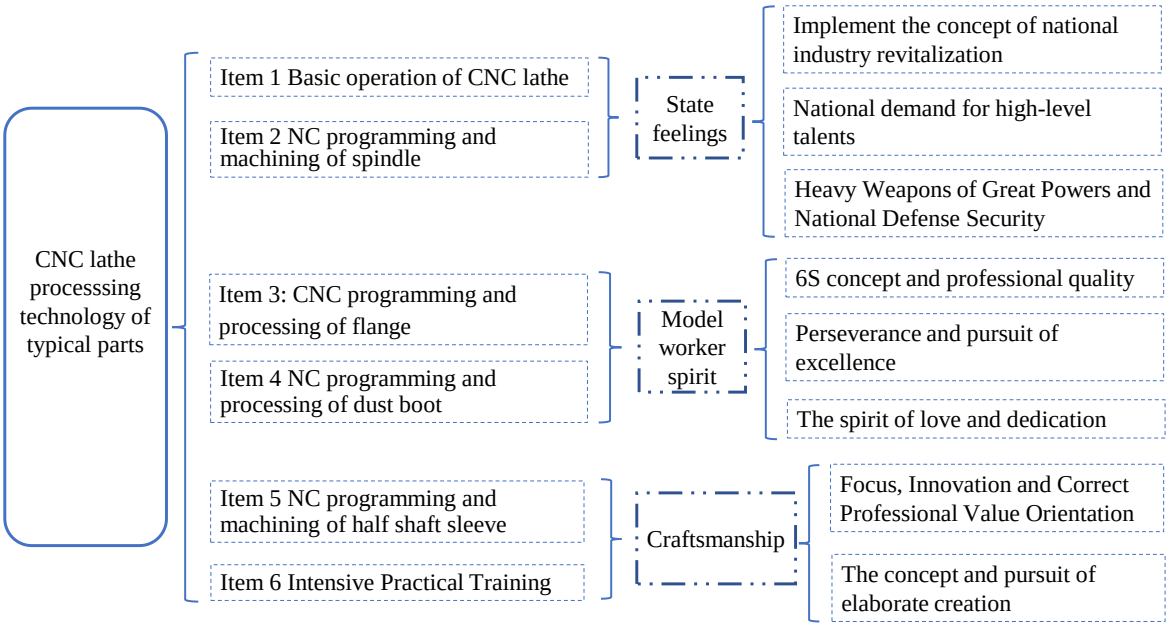

Figure 2: Framework of curriculum ideas

3.3. Integration of New Ideas

1+X certificate (CNC lathe machining, CNC milling, multi axis CNC machining) is a necessary skill. Select the course of CNC lathe machining technology for typical parts. After learning, you need to pass the examination of CNC lathe machining 1+X vocational skill level certificate to obtain relevant certificates. This course is an application oriented and skill oriented professional course, which enables students to feel that numerical control is in the heart, manufacturing is in the shape, and charm is in people, striving to be a small craftsman with professional skills!

The "craftsmanship spirit" is cultivated in the practical skill training of typical parts NC lathe processing technology. Because the NC lathe processing training requires students to observe the operating procedures, be careful and pay attention to quality. The appropriate introduction of the case of "craftsmanship spirit" is conducive to strengthening the students' sense of excellence, promoting the improvement of students' programming and processing skills, realizing the integration of morality and technology, and making unremitting efforts to realize the Chinese Dream of the great rejuvenation of the Chinese nation, and ultimately cultivating the goal of a great craftsman in the new era.

Be able to apply and promote new technologies, new processes, new materials and new equipment to improve product quality and labor productivity, and skillfully consult relevant technical manuals. Based on the principle of practicality and sufficiency, this course focuses on the wide range, essentials and skills of operation process and operation process, as well as how to solve problems encountered in production. Students can not only learn operation skills, but also improve their skills. In the teaching process, the integrated teaching method of "teaching, learning and doing" is adopted to explain and train students' professional basic skills, so that they can easily operate the CNC machine tool.

4. Teaching Reform and Practice

4.1. Reform and Practice of Teaching Methods

(1) Accurately implement strategies to improve students' learning ability and ability to analyze and solve problems. In view of the demand for the ability to analyze and solve practical problems in production put forward by CNC lathe processing posts, we designed and used corresponding teaching strategies to introduce common problems in production into teaching, and guide students from "finding problems" to "learning and thinking", from "analyzing causes" to "solving problems" in the teaching process, Improve students' ability to analyze problems through the cultivation of learning ability, and improve students' ability to solve practical production problems through the integration of teaching and doing.

As we all know, knowledge chain is the logical basis for people to learn and think. Most teachers are used to imparting the knowledge closely related to cause and effect to students as a whole in the teaching process. But facts have proved that in such a learning process, students are so passive that they lose interest in learning and learning ability. In the teaching process of the course "CNC Lathe Processing Technology for Typical Parts", we use the corresponding teaching strategies to "cut off" the knowledge chain and reverse the causal link, so that students can meet problems in the teaching operation, that is, first find "results", and then let students start to explore knowledge by thinking about "causes".

(2) Innovate and apply teaching methods to improve students' operation and processing ability. In the teaching process, on the one hand, we comprehensively use flipped classroom, mixed teaching and other teaching models to highlight the teaching focus, on the other hand, we innovatively design and use teaching methods to break through the teaching difficulties of knowledge and skills. For example, we will show the common production accidents in robot teaching and NC lathe processing through the virtual simulation system, using the "trial and error" teaching method, and strengthen the memory through the way of accident reappearance, so that students can master every knowledge and operation essentials of NC processing. In addition, we also designed and used a live broadcast teaching system to enhance the demonstration effectiveness of "virtual teaching" and robot teaching, improve the per capita class hour ratio of robot operation and virtual operation, and effectively improve students' operation ability.

(3) Interesting learning points and essentials, consolidate and strengthen technical skills. In the teaching practice, we also summarized the key points of robot teaching knowledge, refined the key points of robot operation, and used specific or visual pithy formula such as "crossing mountains and mountains", "making the finishing point", "keeping together for a long time" to make knowledge points and operation essentials such as robot welding process route design, programming instruction application skills, and methods to avoid trajectory deviation interesting, so as to enhance students' memory, It effectively strengthens the students' mastery of NC operation and processing skills.

4.2. Teaching Process Reform and Practice

In the teaching process, we also carried out the reform and practice of the teaching process, extended the classroom teaching before and after the class, clarified the significance of the teaching activities before, during and after the class, designed and implemented the teaching process of independent learning before the class, clarifying the ability objectives, exploring practice and mastering technical skills in the class, expanding military training after the class, and enriching the teaching results based on the ability training.

4.2.1. Self Determination before Class - Knowledge Thinking Cooperation

1) Learn ahead of time, so that students can warm up the project they need to learn, understand the relevant knowledge points, and understand the learning tasks.

2) Ask questions and exchange, deepen thinking to knowledge points, enhance students' initiative to participate, highlight their own difficult problems, and make class learning more targeted.

4.2.2. Internalization in Class -- Construction of Process Capability

1) Create situations and lead tasks. In the actual scene of the factory, students are encouraged to complete the learning task with their working identity and emotion. Carry out ideological and political construction of the curriculum to promote students to correct their ideological attitude.

2) Clarify parameters and break through key points. The students are the main teaching method, and the students can think about the processing instructions and process according to the drawings. Be able to activate the classroom atmosphere and mobilize students' enthusiasm for learning.

3) Simulate machining and resolve difficulties. Guide students to be able to program, and guide students to program in favor of G71 instructions. It is convenient for Yulong simulation software to program and verify G71 instructions, facilitate students to learn the parameters of instructions and set numerical value verification, and can clearly watch the tool's motion track.

4) Enterprise case process and programming training. Student centered, driven by the real tasks of the enterprise. Let students focus on the real application of enterprises through the form of process cards. Strengthen students' application of difficult problems.

5) Complete part simulation processing by group confrontation. Mutual evaluation and comments. Through mutual evaluation within and between groups and teachers' comments, students' ability to solve practical problems can be improved.

6) Group work display. Cultivate students' ability to summarize and express orally. Students can improve their expressiveness and oral expression ability by commenting on the platform.

7) Project evaluation. Choose the best works to stimulate students' enthusiasm and interest in learning. Feedback questionnaire: questionnaire survey is conducted in each class to understand students' evaluation of the class and adjust teaching strategies and methods in time.

4.2.3. After Class - Consolidate Communication and Improve

1) Innovative thinking. Cultivate students' innovative thinking, dare to think and do, can expand and give play to the application of the knowledge they have mastered, and can enrich teaching with rich online education resources.

2) Online and offline mixing and consolidation review. Learn how to solve problems.

5. Reflection on Modular Teaching

5.1. Experience Gained through Thinking

1) A reasonable, effective and targeted teaching guidance process, supplemented by information-based teaching resources, is conducive to students' independent learning, stimulate students' thinking, enhance learning effects, and achieve teaching objectives.

2) Taking the hydraulic connector as the processing task, it is easy to stimulate students' enthusiasm, and is a good carrier for G71 command application.

3) Simulated competition, stimulate students' competitive consciousness, create a tense learning atmosphere, curb students' lazy behavior, and improve the teaching effect.

5.2. Think about What Needs to be Improved

1) The course rhythm is fast, students' learning ability is different, and a small number of students are easily disconnected.

2) The mutual evaluation of the students in the group is not objective enough.

5.3. Think about Progress

1) Actively guide students to help and learn from each other, and encourage and reward groups that "take the fast with the slow, and make progress in the whole group".

2) Positively guide students to make positive and objective evaluation and make common progress.

6. Conclusion

The curriculum modular teaching reform is to organize and construct teaching modules based on ability, sort out and screen knowledge points and skill points; It is a kind of teaching reform practice based on curriculum construction, which aims to design teaching process, implement teaching reform, promote the achievement of teaching objectives and improve the quality of talent training. The curriculum modular teaching reform has the target role of serving the regional economic development and the basic role of achieving the ability goal. It includes two important tasks, one is the ability oriented curriculum construction, the other is the teaching reform based on the ability training.

The modular teaching of the curriculum effectively improves the flexibility, expansion and practicality of teaching by building a network of interconnected teaching theme modules, setting up progressive teaching expansion modules, and setting up complementary teaching methods modules. The personalized needs of teaching objects are met, the teaching content is more complete and systematic, and the teaching objectives highlight the characteristics of application. Practice has proved that modular teaching embodies the student-centered teaching concept, and has a significant positive role in improving the teaching quality of professional courses and helping students understand, master and apply professional knowledge.

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