



Mixed Teaching Innovation and Practice of “CNC Processing Process and Programming” Under the New Engineering Background

Zhichao Zhang^(✉)

Harbin Cambridge University, Harbin, Heilongjiang, China
zhichaozc@163.com

Abstract. This paper is to improve students’ working ability, understand the mixed teaching mode under the new engineering background, cultivate applied skills, CNC talents to meet the needs of enterprises, CNC processing technology and programming. Through the research of school professional ability, establish the learning skills goal, aims to improve students’ professional skills, associated with the production of some enterprises, actively build mixed teaching mode including teaching analysis, teaching design, teaching evaluation, etc., and apply the mode to the curriculum teaching for practical purposes, explore the new engineering background of CNC processing process and programming mixed teaching. This article through the course design, the course teaching innovation and the course practice as well as the mixed type teaching superiority four convenient to the mixed type teaching creation.

Keywords: hybrid teaching · CNC processing process and programming · professional ability

1 Introduction

“CNC processing process and Programming” is a very practical professional basic course. In terms of theoretical knowledge, it must be closely related to the modern manufacturing practice, and emphasize the practicality and application of the course [1]. With the structural adjustment and modernization of China’s manufacturing industry, the talent gap has a widening trend. Moreover, with the rapid development of modern information technology and the initial adoption of 5G technology, the integration of mobile equipment and teaching reform are getting closer and closer, all kinds of teaching AIDS are rapidly popularized, and the traditional education and teaching mode is gradually broken. Supported by modern information technology, based on the actual production case, theory and practice, online, build “online learning”, “teaching theory” and “practice learning” teaching mode system pays attention to cultivate students to apply knowledge and comprehensive professional skills, improve students’ basic skills in the post. The learning goal and focus of CNC processing process and programming design courses is to cultivate compound applied talents with solid theoretical knowledge

and strong practical ability. Whether students can master the CNC processing and programming technology and adapt to the market demand is the key to the implementation of the training task of this course. Therefore, this paper analyzes and discusses the CNC processing process and programming teaching under the new engineering background.

2 “CNC Processing Process and Programming” Curriculum Design

CNC machining technology is the sum of various methods and technical means of processing parts on CNC machine tools, running through the whole CNC machining process, which is a very practical topic, and needs the support of relevant disciplines and courses. First of all, CNC engineering and technicians should have a wide range of knowledge and drawing skills, understand the basic knowledge in the field of interchangeability, understand the structural technical parameters and scope of application of CNC machine tools, and must master the design performance and scope of application. Practical application of tools, master the processing programming method and application objects, the possibility of using CAD / CAM software; solve technical problems in process design, then to understand the usual process addition. [2].

The preparation method and content of the worker, understand its process flow, can distinguish the corresponding characteristics of ordinary processing technology and CNC processing and the necessary connection between each other, and should master the electrical control technology of the machine tool. And the school education reform should be closely around the needs of enterprise development. Today's CNC technology has developed with the development of global manufacturing technology. It is in this background that the curriculum grouping teaching mode is gradually studied and practiced. Its composition includes technical mapping, interchangeability and technical measurement, mechanical technology foundation, CNC Processing Technology and Programming, CAD/CAM technology application, machining training, CNC Processing Training and Diploma Design (CNC Professional) courses. Comprehensive to carry out practical training courses, through the actual operation of CNC machine tools, personally complete the parts production tools. The use of theory and practical mode in group teaching is convenient for students to clearly absorb the basic knowledge of CNC processing process and programming and related peripheral knowledge, which is conducive to the mastery of students' professional technology (Table 1).

Table 1. CNC machining position skills have the requirements

CNC equipment operation position	Can understand the drawings, independently program and operate CNC equipment, and have a certain equipment maintenance and maintenance knowledge.
CNC technician position	Can understand the drawings, independent programming process of the operation instructions, and have a good language expression ability.
CNC product quality inspection position	Can understand the drawings, and have the use and maintenance of measuring tools.
Operation and maintenance position of CNC equipment	Can understand the drawings, can independently program and control the CNC equipment, it has a certain equipment maintenance and maintenance knowledge.
CNC Programming and Commissioning Jobs	Can understand the drawings, independently program and operate the CNC equipment, and have the normal maintenance and use of measuring equipment.

3 “CNC Processing Process and Programming” Curriculum Teaching Innovation

Change the course teaching concept. Talent training in private ordinary undergraduate colleges is the training of compound and application-oriented senior talents. Its teaching concept should be based on talent training. Teaching concept in the school teaching, is the link of social needs and teaching curriculum design, directly affect the professional knowledge can meet the work needs after graduation, the traditional teaching concept cannot keep up with the development of social science and technology, cannot meet the social professional needs, uneven talent level, in order to adapt to the needs of the increasingly diverse society, curriculum learning concept must be closely combined with social science and technology, and according to the needs of units of choose and employ persons [3].

4 “CNC Processing Process and Programming” Course Teaching Practice

Choose the actual parts of the enterprise as the project, the difficulty to choose the project is moderate, try to choose multi-process, multi-programming projects, in order to facilitate the cultivation and improvement of students' comprehensive skills.

First, divide the students into several project teams. The grouping first adopts the student self-linking method, and then the teachers adjust according to the student situation, reasonably match the student distribution practice within the group according to

the general ranking of the good students, and appropriately adjust the students so that the personnel of each group are as balanced as possible. Each project consists of 5 teams of 5–7 people each, covering CNC parts and tooling, CNC processing process design, CNC programming, part manufacturing, and inspection. This is similar to the technical design, process design, CNC programming, production, control door of manufacturing enterprises. Each team has a team leader responsible for organizing the project tasks and coordination between teams within the team.

At the beginning of the project, the teacher first arranges the task, describes the project purpose, content, experimental group mode, overall time planning, existing resources and equipment, and the methods of evaluating the course design results, and then conducts the group design. In the form of a combination of theoretical classroom design, CAD/CAM machine room, and open laboratory use. Every day at the beginning of the experiment, the team leader summarized the achievements and deficiencies of the previous day, put forward the task layout of the project and discuss it together, in order to formulate feasible plans and specific division of work, as well as implement and complete the tasks. Collaboration and collaboration with each other during the implementation process [4].

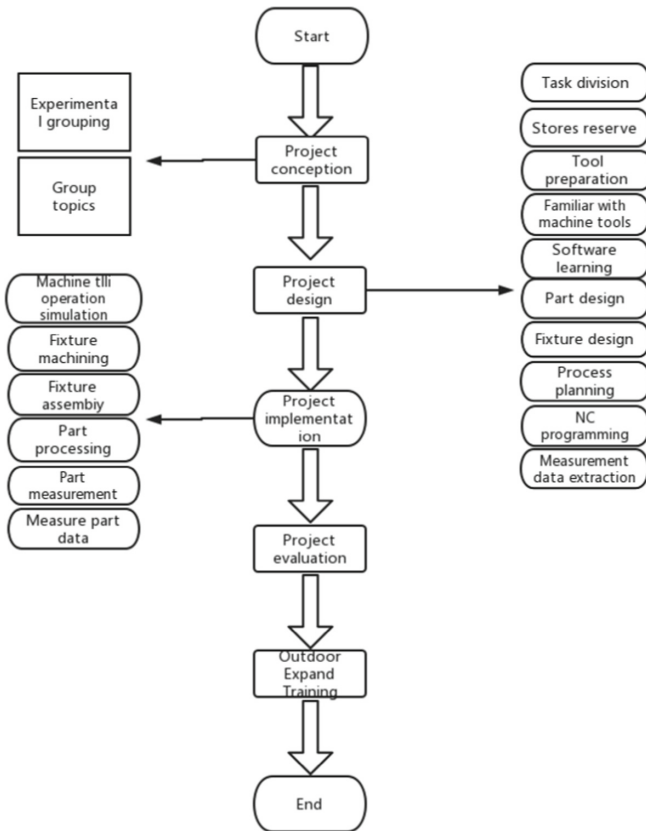


Fig. 1. CNC machining flow chart

The team leader records the progress every day and shall report the project progress regularly according to the needs of the instructor [5]. The team leader shall request for centralized guidance to the teacher according to the work situation within the group. The training teacher should also go to the site from time to time to check and guide the students of the project, and record the completion of the students [5]. Teachers should also ask exploratory questions to students for their common problems, help them think, and can also arrange students to discuss and make suggestions on the research direction and methods. After the completion of the project objectives at each stage, each team will submit a stage summary report, summarize the implementation of the project and the deficiencies, and put forward the goals and requirements for the next stage (Fig. 1).

5 Conclusions

“CNC Processing Process and Programming” is a practical, professional, hands-on course. CNC processing is the use of advanced processing methods and manufacturing technology to produce parts that meet the quality requirements, the previous teaching link is given priority to with theory, with homework and curriculum design as practice, teacher evaluation as evaluation standards, lead to the application level of the teacher students master professional technology, so that the application of professional knowledge is difficult to establish the overall concept. The complete design of the CNC processing process contains the corresponding expertise, including the structure of the parts and the feasibility analysis of the processing process. According to the shape and technical requirements of the parts, the materials and methods of the machine tool and the design and application of the tray are determined by the type and accuracy of the production batch. The part process design should reflect the flexibility of the processing method to form a professional knowledge group with handicraft, which can master the technical characteristics and practical use of the application of the relevant peripheral knowledge and control under the new engineering background.

Acknowledgments. “Mixed Teaching Innovation and Practice of CNC Processing Process and Programming Course under the Background of New Engineering.” 2020 Higher Education and Teaching Reform Research Project of Heilongjiang Province (SJGY20200275).

References

1. Hu Y N, Huo J F, Zhao H J, etc. Hybrid Teaching Mode Construction and Practice Based on Post Ability Improvement-Take CNC Processing Process and Programming as an example [J]. Internal combustion Engine and Accessories (24): 3.
2. Wang J. Innovation and Exploration of Digital CNC Process [J]. Intelligent Manufacturing, 2022 (04): 124–128. Hybrid Teaching Practice Based on the Superstar Network Teaching Platform — Take the CNC Processing Process and Programming course [J]. Light Industry Technology, 2020, v. 36; No. 257 (04): 165–166 + 189.

3. Shi X Y, Fang M. Hybrid Teaching Practice Based on the Superstar Network Teaching Platform —— takes the CNC Processing Process and Programming course as an example [J]. Light Industry Technology, 2020 (4).
4. Jiang X Y, Zhang Y C. Teaching Research on CNC Processing Technology and Programming Course Based on Virtual Factory [J]. Information and Computer (theoretical edition), 2022, 34 (02): 238-240.
5. Xu X J. Application of CNC simulation software in the Teaching of CNC Processing Process and Programming [J]. Automation Applications, 2021 (12): 87-89.

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

